This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

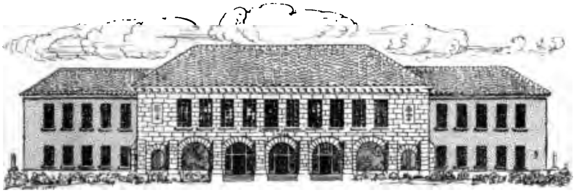
+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

518.2 .M973oi V.2
urche, Vincent T.
oject lessons for infants /
Stanford University Libraries
3 6105 04931 5547

PRESENTED BY THE PUBLISHERS
—TO THE—
TEXT-BOOK COLLECTION
—OF THE—



SCHOOL OF EDUCATION
LIBRARY

TEXTBOOK COLLECTION
GIFT OF
THE PUBLISHERS

STANFORD UNIVERSITY
LIBRARIES

[redacted]

ELLWOOD P. CUBBERLEY.

DEPARTMENT OF EDUCATION
LELAND STANFORD JUNIOR UNIVERSITY

OBJECT LESSONS FOR INFANTS

OBJECT LESSONS

FOR INFANTS

BY

VINCENT T. MURCHÉ

HEADMASTER OF BOUNDARY LANE BOARD SCHOOL, CAMBERWELL; AUTHOR OF 'OBJECT LESSONS IN ELEMENTARY SCIENCE'; AND THE SERIES OF 'SCIENCE READERS' BASED UPON THEM

The Course is intended to be an easy preparation or stepping-stone for the above, and is treated in a manner suitable to the classes in the Infant School

VOL. II

MACMILLAN AND CO., LTD.
BEDFORD STREET, STRAND, LONDON
NEW YORK: MACMILLAN & CO.
1896

All rights reserved

621337

First Edition 1[illegible]95. *Reprinted* 1896.

C

PREFACE

THIS course of Object Lessons for use in Infant Schools is designed as an easy stepping-stone to the author's more advanced course for use in the Senior departments; and is the natural outcome of the widely-extended favour with which the two preceding series of books have been received in the educational world.

In view of the recent changes in the Code, which have set up new relations between the school, H.M. Inspector, and the Education Department, and affect the everyday life of both teachers and scholars, it has been deemed advisable, after consultation with several Infant Teachers, to arrange the course in four stages. Under the old regime the Infant School seemed to naturally resolve itself into three divisions. It is now thought that, under the new conditions, a course of lessons laid down in four stages will be welcomed by most teachers, as giving them a stage at their discretion, to provide for the more rapid class-promotions which will henceforth take place.

The Departmental Circular on Object Teaching recently issued to H.M. Inspectors comments thus:—"*Object teaching leads the scholar to acquire knowledge by observation and experiment, and no instruction is properly so called unless an Object is presented to the learner so that the addition to his knowledge may be made through the senses. Junior teachers have not unfrequently given lessons before H.M. Inspectors, which were wrongly described as Object Lessons, because in dealing with the topic selected, no suitable appeal was made to the eye of the scholar. However well the lesson may be illustrated by diagrams, pictures, models, or lantern slides, if the children have no opportunity of handling and watching the actual object which is being dealt with, the teacher will be giving an Information Lesson rather than an Object Lesson.*"

These were the author's guiding principles in designing the former volumes, and they have been steadily kept in view during the preparation of this series for the younger children. From the very earliest lessons, the eye, the hand, and the senses of taste and smell, are all brought into requisition by the children while dealing with the objects before them; and thus, to quote again from the Circular, "*The imparting of* mere *information* becomes altogether *secondary to the cultivation of the faculty of observation.*"

The same official document lays much stress on the value of black-board illustration. "*Teachers,*" it says, "*shall frequently illustrate details of the lesson by black-board draw-*

ings. Children who are jaded in five minutes by a lecture, will be open-eyed and receptive for half an hour while the teacher draws as well as talks." It is with this principle in view that the lessons have been illustrated with just such pictures as will readily lend themselves to reproduction on the black-board.

Another very important point, touched upon in the Circular, has not been lost sight of during the compilation of these lessons. It says: "*The attempt to teach the children to be accurate in observation cannot be separated from the need of making them accurate in description.*"

Hence all the lessons have been written in full, no single step being left unexplained. This of course will also be a great assistance to the young teacher herself.

Lastly, "*There are,*" says the Circular, "*other important uses of good Object Teaching. It makes the lives of the children more happy and interesting by opening up an easily accessible and attractive field for the exercise of brain, hand, and eye. It gives the children an opportunity of learning the simplest natural facts, and directs their attention to external objects, making their education less bookish. It further develops a love of Nature and an interest in living things, and corrects the tendency which exists in many children to destructiveness and thoughtless unkindness to animals, and shows the ignorance and cruelty of such conduct. The value of the services which many animals render to man should be dwelt upon, and the importance* *of kindly treating them and preserving them should be pointed out.*"

In dealing with the animal world, the writer has made these humanising truths a special feature of the lesson, not only in this series, but also in the books for the older children. The children from the first are led to take a kindly interest in the animals around them. Wherever possible, they are encouraged by the teacher to bring some pet animal to school for the lesson, and every lesson tends to strengthen in them the thought that it is their duty to protect these dumb creatures.

CONTENTS

STAGE III

LESSONS ON FORM 1-14

LESSON PAGE

1. LINES—PERPENDICULAR, HORIZONTAL, OBLIQUE . 1
2. PARALLEL LINES 5
3. THE CIRCLE 7
4. THE SPHERE 11
5. THE CYLINDER 13

LESSONS ON COLOUR—DARK AND LIGHT COLOURS . . 15-19

6. THE REDS, THE YELLOWS, AND THE BLUES . . 15
7. GREEN, ORANGE, AND PURPLE 17

LESSONS ABOUT PLANTS 20-32

8. HOW SEEDS GROW 20
9. LEAVES 23
10. STEMS OF PLANTS 26
11. THE BARK OF PLANTS 29

LESSONS ON COMMON OBJECTS 32-43

12. GLASS 32
13. WATER 35

LESSON PAGE
14. Solids and Liquids 38
15. Salt and Sugar 41

Lessons on Natural Phenomena 43-52

16. A Thunder-Storm 43
17. A Frosty Day 46
18. A Snow-Storm 49

Lessons about Myself 52-60

19. The Blood 52
20. Eating and Drinking 55
21. Breathing 57

Lessons about Animals that fly 60-71

22. Birds—Wings instead of Arms 60
23. Birds—Their Legs and Feet 62
24. Another Chat about Birds 65
25. A Bird's Nest 67

Some other Animals that fly 71-77

26. The Bat 71
27. The Butterfly 74

Learning to tell the Time 77-87

28. A Day 77
29. Hours and Half-Hours 80
30. Minutes 84

STAGE IV

Lessons on Form 91-102

1. The Rhombus and Rhomboid 91

LESSON PAGE
2. FIGURES WITH MANY SIDES 94
3. PRISMS 97
4. THE PYRAMID AND CONE 100

LESSONS ON COLOUR—SHADES AND TINTS . . 102-110

5. THE PRIMARY COLOURS 102
6. THE SECONDARY COLOURS 105
7. BROWNS AND GREYS 107

SOME USEFUL PLANTS 110-130

8. CORN 110
9. VEGETABLES 114
10. PLANTS WHICH GIVE SUGAR 118
11. TEA, COFFEE, AND COCOA 121
12. PLANTS USEFUL FOR CLOTHING 126

LESSONS ON COMMON OBJECTS 130-143

13. INDIA-RUBBER 130
14. A SPONGE 133
15. MINERALS 136
16. CLAY 139
17. THE GUM BOTTLE 141

LESSONS ABOUT MYSELF 144-152

18. THE BRAIN 144
19. THE SKIN 147
20. MORE ABOUT THE SKIN 149

SOME USEFUL ANIMALS 152-179

21. THE COW 152
22. THE SHEEP 155
23. THE HORSE 159
24. THE DOG 163

LESSON PAGE
25. DUCKS, GEESE, AND FOWLS 168
26. THE HONEY-BEE 172
27. THE SILK-WORM 176

LEARNING TO BE USEFUL 179-189

28. LEARNING TO LAY THE DINNER-TABLE . . . 179
29. LEARNING TO WASH UP THE TEA-THINGS . . 183
30. LEARNING TO MAKE THE BED 186

OBJECTS AND OTHER ILLUSTRATIONS REQUIRED . . 191

STAGE III

STAGE III

LESSONS ON FORM

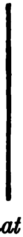
Lesson I

LINES—PERPENDICULAR, HORIZONTAL, OBLIQUE

Introduce the new lesson by drawing lines in various positions on the black-board and calling upon the class to name them. One is an upright or standing-up line, another is a lying-down, another a slanting line. With this introduction proceed as follows:—

"I want you now to learn new names for these lines.

"Look at this upright line again. We must learn now to call it **a perpendicular line.**



"Come and draw another line like it, Fred, and say, 'This is **a perpendicular line. It stands upright.**'

"The walls of our schoolroom are upright. What kind of walls shall we call them?" "**Perpendicular walls.**"

Point out the corner between the two walls. They make a straight line from the floor to the ceiling where they join. What kind of line is it? It is **a perpendicular line.** *It stands upright.*

Lead the children to tell that the legs of the table, the sides of the doors, the door-posts, the upright bars of the window-frames, *as well as the lamp-posts, the church-steeple, the letter-boxes, and the walls of the shops and houses in the street are all* **perpendicular.** *They all stand upright.*

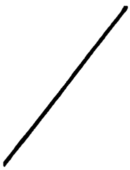
"Now let us look at the lying-down line again. Its proper name is **a horizontal line.**

"Come and draw another horizontal line, Mary.

"Look now along the top of the wall where it joins the ceiling. It forms a line. What sort of line shall we call it?" "**A horizontal line.**"

From this it will be an easy step for them to tell that the bottom line of the walls, the top and bottom of the door, the cross-bars of the window-sashes, the floor and ceiling of the room, the top of the table, and the seats of their desks are all **horizontal.**

"Now, lastly, let us look once more at this line. What do we call it?" "A slanting line."



"Quite right. It is not perpendicular, and it is not horizontal. We may call it a slanting line; but I want you to learn its new name. You must learn to call it **an oblique line. Oblique** means just the same as **slanting.**"

The children may now be exercised in holding their pencils in the three positions as the teacher calls for them, after which the teacher herself may hold her pointer in different positions, and call upon the class to name the position each time. Let them next take their slates and hold them up to represent in turn the walls, the floor, and the ceiling of the room. Call upon them to name the position of the slate each time.

"Now look at this slate as I hold it up. Can you think of any part of the school which the slate is like now?" "The roof."

"What can we say about the roof, then?" "It is **oblique** or **slanting.**"

"I want you to tell me again the position of the top of the table?" "It is **horizontal.**"

"Quite right. Now look at these shelves in the cupboard. What can you say about them?" "They are horizontal too."

"Why are our tables and shelves always made horizontal?" "They are meant to stand things on. If they were oblique, the things would roll off from them to the floor."

Place a ball on the table, and show that it will not roll off while the table is horizontal. Tilt it into the slanting position, and the ball at once rolls down to the floor.

Lesson II

PARALLEL LINES

Commence by drawing a couple of upright lines on the blackboard, say three inches apart. Call attention to what has been done. Let the children give the lines their new name—**perpendicular lines**—*and proceed in the following way:—*

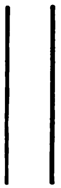
"We are going to learn something more about lines to-day. I shall want one of you to come to the front and help me."

Instruct the child to measure, with the foot-rule, the distance between the lines at several points. He finds the distance to be three inches wherever he takes the measure.

"Here, you see, we have two lines, **standing side by side, always the same distance apart.** We say that these lines are **parallel.**

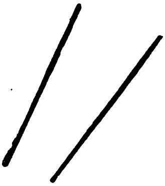
"Look at them again. What name do we give them, because they are upright?" "We call them **perpendicular lines.**"

"What do we say about them, because they stand side by side, and are always the same distance apart?" "We say they are **parallel lines.**"



"Now tell me all you know about the lines." "They are **perpendicular and parallel lines.**"

Clean these lines off and draw two others.

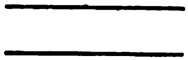


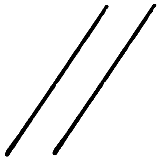
"Are these lines perpendicular?" "No; they are not upright."

"Are they parallel?" "No."

"How do you know they are not parallel?" "They are not the same distance apart everywhere."

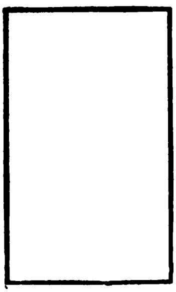
Proceed in a similar way, first with horizontal, and then with oblique parallel lines, placing the parallels each time at varying distances apart. Make the class tell, in each case, why we say they are parallel.



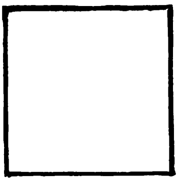


Let two of the children next stretch between them a piece of ribbon a few yards long. Have the width of the ribbon measured in several places, and lead the class to tell that **the edges are parallel. They lie side by side,** *and* **are the same distance apart everywhere.**

The same thing might be done with a few yards of common wall paper, which can easily be obtained for a penny or two; or some strips of brown paper pasted together will do equally well. Make the children tell that the paper is **wide,** *the ribbon* **narrow;** *but* **the edges of both are parallel.**



This would naturally lead to the examination of the seams between the boards of the flooring. Have the width of the boards measured as before, and lead the class to tell that **the seams between them are parallel. They lie side by side,** *and* **are the same distance apart.**

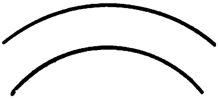


Draw next **an oblong** *and* **a square** *on the blackboard. Let one of the children measure the sides of these figures, and call upon the class to tell that* **the opposite**

sides of each are always the same distance apart. *They, too, are* **parallel.**

It will now be an easy matter for the children to name other things in the room which have parallel sides; such as the opposite walls, the edges of the ceiling and floor, the panels in the doors, the sides of the doors themselves, the uprights and cross-bars of the window-frames, the edges of their slates, and so on.

Lastly, draw some curved parallels, and have their distances from one another measured as before. These are **parallel** *like the others, for they are the same distance apart everywhere. They are not straight, however, but* **curved parallel lines.**



Lesson III

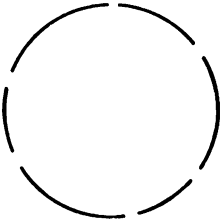
THE CIRCLE

Draw a circle on the black-board, call attention to it, and proceed thus:—

"You can all tell me what we call this figure?" "A circle."

"What kind of lines do we use to make circles?" "Curved lines."

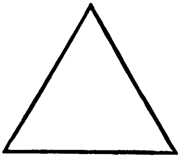
Rub out portions of the circle here and there, leaving parts of the line. Point to each of the remaining parts, and let the children tell that they are all curved lines.



Complete the circle again, and show that the figure is made by joining all these curved lines into one long curve, so that, last of all, the two ends of the line join.

"How many lines do we want to make a circle, then?" "One line."

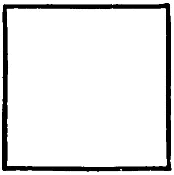
Draw or show a triangular figure. Let the children name it.

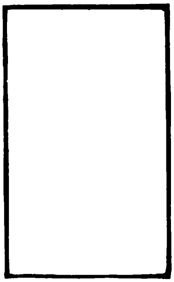


"How many lines must we have to make a triangle?" "Three lines."

"What kind of lines must they be?" "Straight lines."

Draw or show a square and an oblong. Let the children tell what they are, and then proceed to elicit in the same way that each of these figures is made of four straight lines.





Lead them to tell further that the triangle has three corners or angles, the square and oblong four each; but the circle has no corners at all. It is made of **one long curved line.**

"We are now going to see what else we can learn about the circle. I want you to watch me carefully while I draw a good one on the black-board."

Fix a drawing-pin near the centre of the board, with a piece of string attached to it by a small loop. Take the chalk and the end of the string in one hand, and slowly mark a circle on the board round the drawing-pin. Call attention to what has been done, as follows:—

"How many lines have I drawn?" "**One line.**"

"When did I leave off drawing?" "When **the two ends** of the line **met.**"

"What do we call the figure I have made?" "**A circle.**"

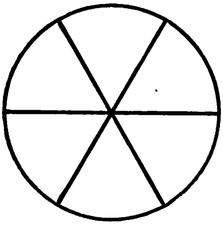
"Look at the drawing-pin inside the circle. Do you know what part of the circle that is?" "The middle."

"You are quite right; it is the middle. But we always give it another name. We call it **the centre of the circle.**"

Pass the string slowly round the circle again, stopping it at several points on the way. Lead the children to tell that this outside curved line is everywhere the same distance from the centre, and that distance is **the length of the piece of string.**

"It is time now for you to learn a new name. Look again at the outside curved line. We call it the **circumference** of the circle. You must try and remember this long word. It means **going all round the circle,** as the chalk did when I made the figure.

"I will now remove the drawing-pin, and dot the centre with the chalk, so that we may see where it is. Watch while I draw some straight lines **from the circumference to the centre.**



"What can you tell me about all these lines?" "**They are all the same length.**"

"How do you know?" "The piece of string will measure the distance between any part of the circumference and the centre. **These lines are the same length as the string.**"

"We call each of these straight lines between the circumference and the centre **a radius** of the circle.

"Now I want one of you to come and help me. Very well, John, you shall come."

Proceed to pin a sheet of paper on an ordinary drawing-board, and after laying it flat on the table, fix the drawing-pin, with the string attached to it, in the middle of the paper. Place a piece of coloured chalk and the end of the string in the child's hand, and instruct him to mark out a circle on the paper just as teacher did on the black-board. That done, let him remove the string, make a chalk mark to show the centre, and then cut out the circle with the scissors. This paper circle may now be *pinned up over the one that was drawn on the board. It fits it exactly.*

"We are next going to draw some straight lines on our paper circle.

"What shall we call this line from the circumference to the centre?" "**A radius.**"

"Suppose I draw it through the centre to the other side of the circumference. What will that be?" "That will be **a radius** too."

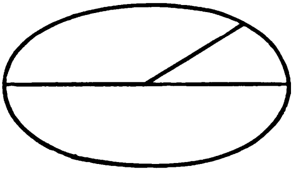
"What can you tell me about these two lines?" "**They are both the same length.**"

"Now look at the whole line from one side of the circumference to the other, for I want you to learn its name. It is called the **diameter** of the circle. The **radius,** you see, is **just half as long as the diameter.**

"Now, last of all, I want you to see why we call this line the diameter."

Remove the paper circle from the black-board, fold it carefully along the diameter that has been drawn, and call upon the class to tell what they see. The folded parts of the circle are **exactly the same size. The diameter cuts the circle through the centre into two halves.** *Each part is* **a half-circle.** *We sometimes call it* **a semi-circle.**

Draw an oval on the board, side by side with the circle.



Lead the children to tell that this figure is also made by one curved line. Is it a circle? Let us see. Draw the long diameter. Find the centre, and from it draw other radii to the circumference. Lead the children to tell that **these lines are not all the same length,** *as they are in* *the circle. This figure is not a circle.* **We call it an oval.** *It is like a circle pressed flat. Make a circle of wire, and show how it may be flattened into an oval shape.*

Lesson IV

THE SPHERE

Place side by side on the table a few of the kindergarten balls, one or two marbles, an orange, a large india-rubber ball, and any other of the spherical objects, with which the earlier lessons have made the children familiar. Proceed with the lesson in some such way as this :—

"I want you to look at all these things. You know they are all the same shape. What shape do we call it?" "**Ball-shape.**"

"Why do we say these things are ball-shaped?" "Because they are **round all over like a ball.**"

"You are quite right. But suppose we now learn to give them a new name. Instead of **ball-shaped,** I want you to say **spherical.**

"I will tell you what the new name means. You call this round thing **a ball.** It has another name—a hard one. It is sometimes called **a sphere.** When I want to talk about its shape I might say it is **sphere-shaped.**

"What would that mean?" "It would mean **ball-shaped**; because **sphere means the same as ball.**"

"Now try to remember that **spherical** only means **sphere-shaped** or **ball-shaped.** When we say anything is spherical, we mean that it is round all over like a ball.

"Now tell me what is the shape of all these things on the table." "**Spherical.**"

"Why do we say they are spherical?" "Because they are round like a sphere or ball."

Take the orange, and cut it in halves cross-wise, not from top to bottom. Be sure and select a very round one for this lesson. Place the two halves on a plate, with the cut edges downwards, and call attention to their shape as follows:—

"What is the shape of each half of the orange as you look at it?" "It is **curved,** or **round all over.**"

"Take one of them up, and look at the part which was cut. Is that round all over too?" "No; that side is **quite flat.**"

"What shape would you call it?" "**Circular.**"

"So then each half of the orange has **a rounded** or **curved side,** and **a flat circular side.**

"Suppose I join the two halves by putting their flat sides together. What shape will they be?" "They will be round like a ball again."

"What might we have called the orange before I cut it?" "**A sphere.**"

"Why?" "Because **sphere** means **ball**; and **the orange** is **a ball.**"

"What did I do to the orange?" "You cut it in halves."

"What may we call each half of the orange then?" "**Half-a-sphere.**"

"Now I want you to remember a hard word which means that. We shall learn to call the half of the orange a **hemisphere.** If we cut any ball into two halves we make two **hemispheres.**"

The teacher would do well, if time permit, to utilise the divided orange to make the children recapitulate many of the facts taught in the previous lesson about the nature of a circle; such as **centre, radius, diameter, semicircle, circumference.** *By removing the inner pulp from the rind, the distinction between* **a circle** *and* **a ring** *might again be shown.*

It was with a view to this that the orange was divided cross-wise (and not from top to bottom) at first.

Show a lemon now. Lead the children to tell that it is not the same shape as the orange and the ball. It is not round all over like the ball.

Cut it through from top to bottom. Show the section, and lead the children to tell that it is not a circle, but **an oval.** *Lead them to tell that cocoa-nuts, plums, and eggs are the same shape as the lemon. We say they are* **egg-shaped.**

Lesson V

THE CYLINDER

In introducing this object, remind the children that we have dealt with round things of several kinds. We have had some things **round and flat like a penny**; *others* **round and hollow like a ring**; *and others* **round all over like a ball or sphere.**

Show now a few cylindrical objects, such as a lead pencil, a pen-holder, a round ruler, a piece of broom-handle, a round tin canister.

Take any one of them—say the canister—and lead the children to talk about its shape.

"Look at the top and bottom of the canister. What can you say about them?" "They are both the same shape."

"What shape is that?" "**Circle-shape,** or **circular.**"

"Yes; the top and bottom are **circle-shaped,** and they are **flat.** We can stand the canister on either end."

Trace their shape in chalk on the black-board. Let the children examine the ends of each of the other articles, and tell that they are flat and circular too.

"Now look at the other part of the canister. What can you tell me about that?"

The children will most probably fail here. Take a sheet of paper, exactly the length of the tin, and wind it round till it *covers it completely. Cut the paper off to the required size and then open the sheet and show its shape. It is an* **oblong.**

If the paper were cut a little full, the two edges might be gummed quickly together, and the canister removed. The shape would in this way be made clear to the minds of the children. It might be very much enhanced if paper circles were cut and fixed on the top and bottom. The whole shape of the canister would have been analysed before them.

Proceed to deal with some of the other objects, e.g. *the round ruler, or the piece of broom handle, in the same way, letting the children themselves take the lead this time.*

"Now you can see that all these things are the same shape. The **ends** are **flat** and **circular,** and if we fold a sheet of paper round either of them to cover it, the paper will always be **oblong in shape.**

"When we look at the ruler we know that its **two ends** are **flat and circular,** and its **sides** are **round** and **long.**

"Anything like this **canister,** or **the round ruler,** is called a **cylinder.** It is a long word for you, but I think the canister on the table will help you to remember it.

"All the things on the table have the same shape as this. We may say that they are **cylinder-shaped.**"

Close the lesson by calling upon the children to name all the cylinder-shaped objects they can—the teacher stepping in where they fail.

N.B.—*To be perfectly logical and consistent, one ought to proceed to derive the better term* **cylindrical** *from* **cylinder-shaped.** *But perhaps it might be as well to defer this till later.*

The same remark applies to the term **spherical** *in the preceding lesson. However, as this is a matter entirely for the individual teacher's discretion, the names can be given or omitted as she pleases. It was given there to indicate the mode of approaching it.*

LESSONS ON COLOUR

DARK AND LIGHT COLOURS

Lesson VI

THE REDS, THE YELLOWS, AND THE BLUES

The colour lessons in this stage should be treated in much the same way as those in Stage II. That is to say, the whole of the teaching should be as practical as possible, and all the experimental part should be actually done in front of the class, with the assistance of one or two of the children.

The colours required should be carefully selected beforehand, and a sufficient quantity of each prepared in small saucers, as indicated in the preceding stage.

In dealing with the reds, yellows, and blues in this lesson, it will not be necessary to prepare all the various shades of these colours. The children, before commencing, are familiar with the simple colours themselves. All the lesson professes to teach is that although there is but one colour—red—yet this red is darker or lighter than that, and so on.

Mark out on a sheet of drawing-paper nine small circles arranged in rows of three each; fix the paper to a convenient part of the black-board with drawing-pins, and bring two children to the front to assist. The two might take their turns at painting, and washing the brushes in water, as they are laid aside after being used.

Carmine will be the best standard red for this purpose; crimson and royal scarlet will give the dark and light shades of the same colour.

Naples yellow No. 2 *in like manner will give a bright* *standard yellow; the dark and light shades of which may be represented by a deep chrome on the one hand, and a lemon yellow, or primrose, on the other.*

Ultramarine, indigo, and cobalt will be the most suitable blues.

Commence with the carmine, and paint that colour in the middle circle of the top row. Call upon the class to name the colour—**red**—*and to tell the shape of the figure that has been painted; and proceed as follows:*—

"Now, John, I want you to paint the circle next to mine with some of the colour out of this saucer."

(*Teacher herself will assist, of course, if necessary, to save time.*)

"What is the colour of John's circle?" "**Red.**"

"But *my* circle is red. Are they both alike?" "No; John's colour is not so bright as the first one."

"You are quite right; but I think we will put it in another way. One of them is darker than the other. Which is the dark colour?" "John's colour is **darker** than the other."

"Quite right this time. Now, while John is cleaning his brush, Jane shall paint the circle on the other side with some of the colour out of this saucer.

"What is the colour of Jane's circle?" "**Red.**"

"Is it like mine, or is it a dark colour like John's?" "It is not like either."

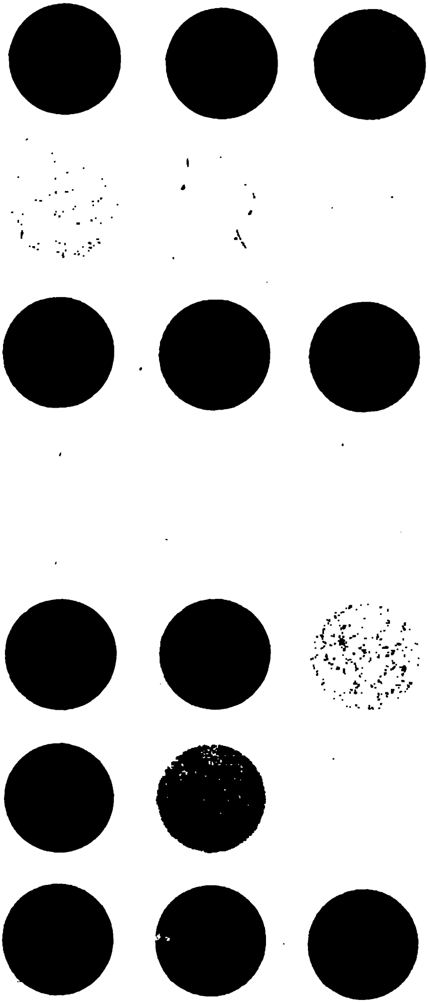
"Why is it not like either of the other two?" "It is **not so dark** as they are."

"Isn't it as dark as the middle one?" "No; the middle one is **darker** than that, and John's circle is **darker still.**"

"Now I think we shall be able to understand all about it. The middle circle is red; **all three are red,** but the one on the left is **a darker red,** and that on the right is not so dark.

"We say that John's circle is **dark red,** Jane's **light red.**"

The coloured paper strips and wools of the three shades of red



would afford ample and interesting exercises in selecting and matching the colours.

This done, the **yellows** *and the* **blues** *should be dealt with in precisely the same way.*

"Let us now look once more at our circles on the paper. I began by painting up, one by one, the colour red, yellow, or blue, as we first learned to know it. Now we have on the two sides of those colours other reds, other yellows, and other blues, some darker, some lighter than the first.

"Come and point out all the dark colours, Harry. Now point to the light colours.

"We learned to call red, yellow, and blue the **three simple colours.** Can you tell me why?" "Because **all the other colours can be made from them.**"

"Quite right; and now I think you may learn a better name for them. Instead of calling red, yellow, and blue the simple colours, you must now try and remember their better name. We call them the **three primary colours,** and that means the **three first colours.** They are the first colours because **all the others can be made from them.**"

DARK AND LIGHT COLOURS

Lesson VII

GREEN, ORANGE, AND PURPLE

In dealing with light and dark shades of these—the secondary colours—the teacher should prepare and mix them herself, from the three primary ones, before the lesson. Thus, having obtained a good grass green by the first mixing, she can easily change it to a lighter or a darker shade by adding a little more yellow or blue, as the case may require.

The same applies of course to the other colours—orange and *purple. In the former,* **the warmth and depth of the tint** *will be increased by adding a little more red; the* **brilliancy** *by adding yellow. On the other hand, an additional quantity of red* **will brighten the tint** *of purple; and blue must be added to produce* **a darker shade** *of that colour.*

The mixing of the colours, however, is no concern of the children's at this stage. As in the previous lesson, the only object now is to teach them that there are varying shades and tints of the same colours.

Proceed, as advised in Lesson VI., by pinning on the blackboard a sheet of drawing-paper, on which nine small circles have been previously drawn in pencil. Bring two children to the front "to help teacher" as before.

*Commence with the greens, the teacher again taking the middle circle, and painting up the grass-green colour in it herself. When the children have named the colour—***green***—she may call upon her little assistants to put up the other shades of that colour as she directs, and then proceed:—*

"Now, children, I want you all to look at these three painted circles. What is the colour of the middle one?" "Green."

"What is the colour of the one that Kate painted?" "Green."

"What is the colour of Fred's circle?" "Green too."

"Are they all alike then?" "No; Fred's colour is **a darker green** than either of the others."

"Quite right; and what can you say about Kate's colour?" "That is **lighter** than the other two."

"Come and pick out a green, like the middle one, from the colours on the table.

"Now find a dark green like Fred's. Now a light green like Kate's."

The class should be exercised in picking out and matching the various shades of green, using their paper strips and coloured wools, as in the last lesson. After this the other two colours —orange and purple—may be treated in exactly the same way.

When the nine circles have been painted, call attention to their arrangement. In addition to the orange, green, and purple first put up, we have now, side by side with them, **other shades of orange, other greens,** *and* **other purples,** *some* **darker,** *some* **lighter.**

Have all the light colours pointed out, then all the dark ones.

Lead the children to tell that there are also light and dark reds, yellows, and blues; and then put them through a brisk exercise in picking out, from the colours on the table, a light green and a dark red, a dark purple and a light yellow, a dark blue and a light red, and so on.

Lastly, proceed to deal with the colours of the lesson as secondary colours, thus:—

"What is the new name I gave you for the three colours—red, yellow, and blue?" "**Primary colours.**"

"What did you call them before I told you the new name?" "Simple colours."

"What does primary mean?" "It means **first.**"

"Why do we call red, yellow, and blue the first colours?" "Because we can make all the other colours **by mixing them together.**"

"Do you know any colours we can make by mixing primary colours together?" "We make green **by mixing blue and yellow**; orange **by mixing red and yellow**; and purple **by mixing red and blue.**"

"What name do you give to these colours—green, orange, and purple—because they are made by mixing other colours together?" "We call them **mixed colours.**"

"Yes; but now it is time for you to learn a better name for them. You must learn to call them the **secondary colours.** If you remember that red, yellow, and blue are primary or **first colours,** you will not be likely to forget the new name, **secondary colours,** for green, orange, and purple."

LESSONS ABOUT PLANTS

Lesson VIII

HOW SEEDS GROW

I. Introduction

Place a few peas and beans on the table in separate saucers. Call the attention of the children to them, and commence in this way:—

"What have I in this saucer, children?" "Some beans."

"And what are these things in the other saucer?" "Peas."

"Where did they come from?" "They grew on plants. **They are the seeds.**"

"On what part of the plant do we find them growing?" "They grow in **pods,** or **shells,** which hang from the stem."

"What hung from the stem before the pods grew there?" "**The flowers.**"

"Quite right. The flowers always come first; and when they die off, they leave something behind them. What do we call it?" "We call it **the fruit** of the plant."

Show some pea and bean pods with the seeds in them.

"Look; do you know what these are?" "They are **the pods** in which the **peas** and **beans** grow."

"Then what part of the plant must they be?" "They are **the fruit** of the plant."

"Yes, they are the fruit; and here are the seeds inside them.

"These pods, you see, look dry, hard, and brown. Did they always look like this?" "No, they were **soft and green** when they were growing on the plant."

Of course, if the season permitted, the teacher would have a few green pods for inspection, as well as the dried, ripe ones.

"What becomes of the seeds of plants?" "They grow into new plants if we put them in the ground."

"Quite right. Now I thought you would like to learn how these seeds grow up into plants, with roots, stems, and leaves of their own, so I have been growing some to show you."

The teacher should be provided with three flower-pots, containing peas or beans in various stages of growth. This may be secured effectually by setting the seeds at intervals, varying from a month to a few days before they are required for the lesson. All that is necessary is to keep the soil in the pots moist, and stand them in a sunny window, away from the frost (if there should be any).

It would be well also to provide a few beans, that have been soaking in water during the day.

II. THE GERM

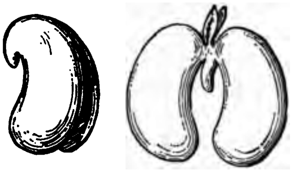
Let the soaked seeds be handed round the class first. Point out the **loose, wrinkled skin** *that covers the seed. Compare it with the skin of a bean that has not been soaked. That looks* **hard, smooth,** *and* **shiny,** *but this one is* **swelled up** *and* **wrinkled.** *The soaking has made the change.*

Take next the flower-pots in succession, beginning with the most recently prepared one. The seeds in this pot have been in the soil about a week. Shake them free from the soil, and let the children examine them as they did the soaked seeds.

The first thing to notice will be that **the skin of these**

seeds is swollen and wrinkled, *just as the skin of the other seeds was. One or two will probably be swollen to bursting, some may actually have burst already.*

Show some that have burst open. Remove all the skin carefully, and call attention to the actual seed inside. Explain that **this thick outer** *skin is only meant* **to take care of the seed.**



Point out that the seed is in **two pieces,** *that are held together in one spot by something that looks* **like a little hinge.** *Tell that this little hinge is really the most important part of the seed. It is* **the little new plant itself.** *It will grow into a big new plant if we leave it in the soil. We call it* **the germ of the new plant.**

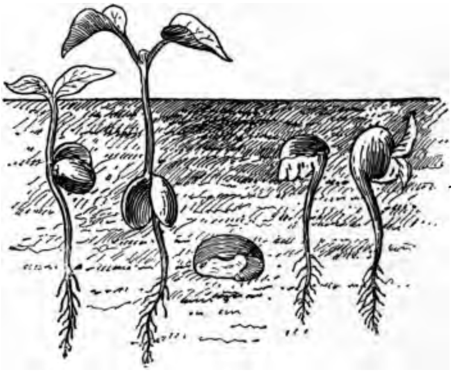
III. The New Plant

Take another flower-pot, in which the growth is farther advanced. Turn the contents of the pot out as before, shake the seedlings free from the soil, and call attention to the two new parts, which are to be seen stretching in opposite directions from the seed itself. Take the plumule first. The name may, or may not, be given at the teacher's discretion. Point out that it is really **a tiny bud. It is making its way up** *through the soil. When it breaks through into the air above,* **it will form a stem with leaves on it.**

Turn next to the other part. Tell that this part **stretches downwards into the soil.** *There are* **no buds on it,** *for it will never grow leaves. It is* **the tiny root** (*radicle*) *of the new plant.*

Let the other pots be now turned out in the same manner, so that the children may watch the development of the two parts of the plant up and down.

The last one will show actual plants, with fully developed **leaves above the ground,** *and* **a root with branching fibres** *all round it.*



It would interest the children to show them some other seeds, such as pips from oranges and lemons, apples and pears, the kernels from plum and cherry stones, and even some of the seeds of our common garden flowers. They should be led to find in them the very parts which they have found in the peas and beans.

Lesson IX

LEAVES

I. Introduction

Show a growing plant of some kind. Call attention to its leaves, and proceed at once, in some such way as the following, to elicit from the children all they have to tell of the common characteristics of leaves, so far as the subject has been dealt with in the earlier lessons.

"We are going to have a chat about the leaves of plants to-day; but you yourselves must begin by first telling me all you can about them.

"Look at the leaves of this plant, and see what you can find to tell me. Well, Mary, suppose you begin." "Each leaf is **in two parts.**"

"Quite right. Come and show me one of those parts. What is that called?" "The **blade** of the leaf."

"Now point to the other part. What is that called?" "The **foot-stalk.**"

"What is the foot-stalk for?" "**To join the leaf** to the branch of the stem on which it grows."

"How can you always tell when your plants are not well, or when they are dying?" "The leaves **droop** and **hang down.**"

"Do these leaves hang down?" "No, **they stand out straight** from the stem."

"Yes, they always spread themselves out when the plant is healthy. One side of the blade faces the sky, the other faces the ground. We may say that the leaf has **an upper side** and **an under side.**

"This table-top, you know, has an upper side and an under side. Come and point them out, Fred. What can you tell me about the position of the table?" "It is **horizontal.**"

"Just so; and we may say too that **the leaves** of the plant are **horizontal.**

"While you are here, Fred, look at the two sides of the leaf, and perhaps you will find out something else." "The two sides are not the same colour."

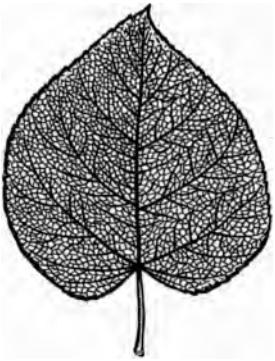
"You are not quite right there, my boy. Think again. The colour of both sides of the leaf is green, is it not?" "Yes, but **the top side is a darker** green than the under side."

"Now you are quite right, and I want you to remember this, because the top side of nearly every leaf is a darker green than the under side."

II. The Veins

"I want you now to have another look at the under side of the leaf. Can you see anything else to talk about?"

"I can see some thick lines, like cords, running through it."



Tell that these are called **the ribs.** *Show that they start from the foot-stalk and stretch out to the edge of the blade. Remind the children that the leaves must be kept spread out to the light and air.* **The stiff, strong ribs do this.**

It would be well to provide a good collection of simple leaves, so that the children may examine them and see for themselves.

Direct them next to hold their leaves up to the light, and lead them to talk about the other lines which they then see all over the blade. Tell that they are **the veins;** *they spread themselves all through the leaf, and cross each other* **like the threads of a net.** *Let them point out the ribs and veins in various leaves.*

N.B.—*The distinction between reticulated and parallel-veined leaves has, of course, no place here.*

III. Kinds of Leaves

Having thus far dealt in a simple way with the characteristics common to all leaves, proceed to show, by a few examples, how leaves differ one from another.

1. **Rough and smooth leaves.**—*Cucumber, vegetable-marrow, scarlet-runner, and vine leaves would serve to illustrate the form of these. Cabbage, lettuce, rhubarb, apple, pear, and plum leaves the latter.*

Let the children take the leaves in their hands, and find for *themselves the short, stiff hairs all over the blade, which give the feeling of roughness to the one; and then let them note the soft, smooth, and often glossy appearance of the other kind.*

2. **Edges, smooth or notched.**—*Deal with these in a similar way, providing as before ample examples of common leaves for examination. Thus the cabbage, lettuce, and rhubarb leaves have smooth edges; but the edges of the rose, lime, apple, pear, strawberry, and horse-chestnut leaves are all more or less cut and notched.*

This will probably be sufficient for one lesson. Further interesting lessons may be given, dealing with the simple and compound leaves, the varying shape and colour of leaves, and so on.

It would serve to interest the children in the subject if the teacher would keep a scrap-book of pressed leaves of as many varieties as possible, for illustration. The leaves could be easily collected during the growing season. All that is necessary is to press them well between sheets of blotting-paper to dry out all their juices, and then gum them in their places in the scrap-book and name them.

The children would soon begin to show their interest by making little collections of their own, "like those in teacher's book."

Lesson X

STEMS OF PLANTS

I. INTRODUCTION

COMMENCE by leading the children to think about their lesson on the growing seed. From the seed itself two parts grew. One stretched down into the soil to form the root of the new plant; the other made its way up to the surface of the ground. We are going to talk about this one to-day.

"Think of those little plants I showed you. What parts of them could you see above the soil in the flower-pot?" "The **stem** and the **leaves**."

"What does the stem do after it has made its way above the ground?" "It keeps on growing up **higher and higher.**"

"Why?" "It is trying to grow up **towards the light and the air.**"

"Quite right. You must remember this, for plants must have light and air, as well as food from the soil."

II. KINDS OF STEMS

1. **Soft, green stems.**—"Now I want you to think of the seeds, which father puts into the garden in the spring-time, and the plants that grow up from them.

"How long do these plants live and grow?" "They only live **during the summer**; they die when the cold weather comes."

Provide a few simple annuals for illustration. Tell that these all grew from seeds which were put in the ground in the early part of the year; they will die at the end of the season.

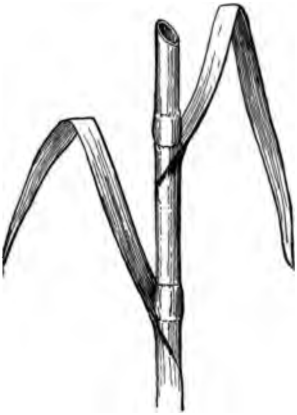
Call special attention to their stems. Let the children themselves examine and describe them. They are **soft** *and* **green.** *They are* **not very strong.** *They* **easily break.**

Explain that as these plants are small, and have such short lives, they do not want thick, strong stems.

Some of them, such as the poppy, stock, and aster, have thicker and stouter stems than others. They **stand upright,** *and hold their leaves and flowers well above the ground.*

Some, such as peas and beans, the convolvulus, and the canary creeper, have such **thin, weak, green stems** *that they* **cannot hold themselves upright.** *Show the scarlet-runner (which may have been kept growing in the pot for the occasion). Point out how it has grown by* **twining its stem round the**

stick *in the pot. Tell that almost all plants with thin, weak, stems do this.*



N.B.—*The distinction between climbing and twining stems need not be considered here.*

Show next some tall grass. Point out the stem. It is **round** *(or as they have learned to distinguish it—cylindrical). It looks stiffer and stronger than we might expect from its size. Cut it across, and show that it is* **a hollow stem,** *and that it has* **joints** *or* **knots** *here and there. It is this that makes the stem strong enough to stand upright.*

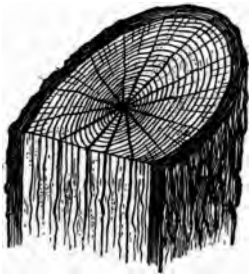
2. **Hard Stems of Wood.**—"I want you next to think about the trees. They do not die down at the end of the summer. They live on year after year.

"We cannot bring a great tree into school to look at; so we must look at this picture of the tree instead.

"Come and point to the stem of the tree, Harry. What do we call the stem?" "The **trunk** of the tree."

"What is it made of?" "It is **made of wood.**"

"Quite right. I have here a piece of the trunk of a tree to show you. If you take it in your hands you will find that it is **hard** and **heavy.**



"I want you to look at those **rings in the wood,** one outside the other. Every year the tree lived, a new ring of wood grew outside the old one.

"When we count these rings then, what can we tell?" "We can tell **how many years the tree lived.**"

"Yes; that is right. Every year the stem of the tree got bigger. Some trees are very big and thick.

"Now look at these great arms that stretch out from the trunk of the tree. Do you know what we call them?" "The **branches.**"

"What are they made of?" "**Wood.**"

"Yes, they are made of wood, too, and so are **the smaller branches,** and even **the little twigs** on which the leaves grow.

"What do we do with the wood of trees?" "We cut it up to build our houses and make all sorts of things for our use."

Lesson XI

THE BARK OF PLANTS

I. Introduction

"I WANT you to think for a few moments about your own bodies, children. You know that your bodies are made of flesh and bones, and that there is blood all over your bodies. But what is there outside the flesh and bones to take care of them?" "The **skin.**"

"Quite right. We are going to talk to-day about **the outside skin of plants;** for plants like ourselves have a skin to cover them. We call this skin **the bark of the plant.**"

II. Soft Stems

Take a few simple annuals, as in the preceding lesson, and lead the children to describe their stems. Let them tell why such plants always have stems of this kind.

Remove the outer skin from the stems of one or two, by peeling it off with the help of a sharp knife. Let the children examine it and see that it is **a thin, tough skin.** *Let them examine also the exposed part of the stem itself. It is* **soft and moist.**

Call attention to **the watery juice** *which is oozing out through the part that has been cut. People sometimes say* **the plant is bleeding.** *This juice is* **like the blood of the plant.** *We call it* **the sap.** *What happens when the outside skin of our body is broken, or scratched, or torn?*

Lead the children now to tell of the work of the root. It is **always sucking up water and other things** *from the soil. Explain that this makes the juice which they see in the cut part of the stem. If they crush up the soft stem or the leaves of a plant in their hands, they will find their hands* **quite wet with this juice.**

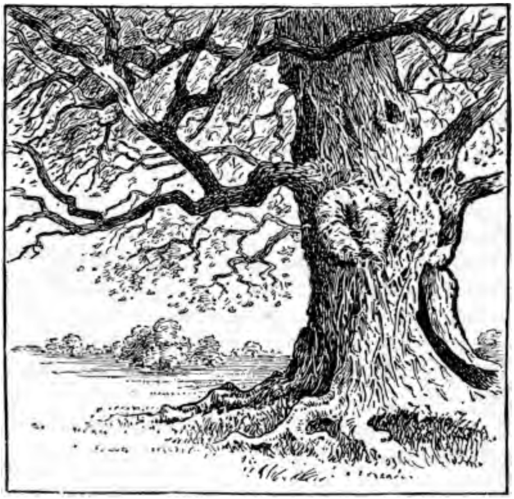
Take next a leaf of some kind, and remove its outer skin in a similar way. **Every part of the plant,** *like every part of our body,* **is covered with an outside skin.**

III. Hard, Woody Plants

"What name do we give to the plants with hard, woody stems?" "We call them **trees.**"

"Quite right; and we are going to talk about trees next. But we shall have to use a picture as we did before, because we cannot bring a tree into school for our lesson.

"Look at this picture of the tree. How rough the outside of the trunk looks.



"The tree, like other plants, **has an outside skin** or **bark**; but the skin of the tree is **very thick.** It has been growing thicker and thicker every year. It is like **a great, thick over-coat** for the tree."

Lead the children to tell that trees live on year after year, through the bitter cold and frost of winter, as well as during the fine, warm, sunny weather. Their thick great-coat takes care of them.

Point out places in the stem, where the bark looks **split** *and* **stretched.** *Tell that the tree has only had this one coat all its life. It has sometimes* **grown too big** *for its coat, and this has made the coat split in places. After a time more bark grows and fills up the places. It is this that makes* **the outside of the trunk look rough.**

Show the piece of stem that the children examined in the previous lesson. Direct the attention first to the rings of hard wood inside, and then to the outer bark. Let them test the hardness of the two with the point of a knife. **The bark is much softer** *than the wood itself.*

Lastly show some **cork.** *Lead the children to tell that this, too, is* **the bark of a tree.** *Tell them that it is the bark of a tree* **called the cork-tree,** *which is grown only for the sake of its bark.*

Put a piece of the cork in a basin of water with a piece of one of the heavy woods—say oak. Lead the children to tell that it is **much lighter than wood.**

Tell that, because it is so light, it is made into belts to keep people from sinking in the water. It is also used for making boats, which are so light **that they cannot sink.**

Show an ordinary bottle-cork. Force it into the neck of a bottle. Tell that cork is useful for this purpose, because when it is squeezed into the neck of the bottle **it tries to stretch itself out to its full size,** *and so keeps the mouth of the bottle close.*

N.B.—*The property of elasticity need not be mentioned here. It will be dealt with later.*

LESSONS ON COMMON OBJECTS

Lesson XII

GLASS

"I WANT you all to think about our schoolroom, children. What a bright, cheerful, happy place it is. Try and think what it would be like, if some one were to take out all the windows, and block the places up with bricks and wood.

"Do you think it would be a bright, cheerful place then?" "No; it would be **dark**; we should **not be able to see** each other."

"Why would it be dark?" "Because the bright **sun** would **not be able to shine** into the room."

"Why not?" "Because the light will not shine through bricks and wood."

"But it shines through the window, how is that?" "The window is made of **glass.** The **light will come through glass,** but not through wood."

"Did you ever see the light coming through the window?" "Yes. When the sun is shining we can sometimes see the light shine through the window, and make a bright place on the desks and the floor."

Have a sheet of glass fixed up, before the lesson commences, in some convenient corner of the room, with a lighted candle behind it. Place them in such a way that the candle itself cannot be seen, and stand a slate or a drawing-board in front of the glass. Let a boy now be sent to bring the drawing-board. Tell the class to take note of what he does, but say nothing to them of the arrangement behind the board.

As soon as the board is moved, the children see the light streaming in from behind the glass; but they cannot see what is giving the light. Move the candle and place it now in such a position that it may be seen behind the glass. The children see, this time, not merely the light, but the candle that gives the light; and both are on the other side of the glass.

"Now let us see what all this means. The candle has been burning there ever since our lesson began, but we could not see it, or the light from it, at first.

"Why not?" "Because the board stood in front of it, and **light will not pass through wood.**"

"When the board was removed, what did we see first?" "The bright light that came from the candle."

"Why did we see the light then?" "Because **it shone through the glass.**"

Lead the children to think about their lesson on the eye. Let them tell of the **pupil,** *the* **window of the eye.** *Remind them that we are able to see things, only because the light* *shines into our eyes through these little windows. The light from the candle shone first* **through the sheet of glass,** *afterwards* **through the little windows of our eyes,** *and then we were able to see it. When the candle itself was put behind the glass, we saw that too.*

"Now you must try and remember a hard word. We say that glass is **transparent,** because we **can see through it,** or because **light will shine through it.**

"We could not see through the board just now, because light will not shine through wood. We have another hard word which means all that. You must try and remember this word too. We say that the board is **opaque,** because we **cannot see through it,** or because **light will not shine through it.**

"If I look through the window, I can tell you about all sorts of things outside in the street, for I can see them through the window.

"Why?" "Because the window is made of glass, and glass is **transparent.**"

"If I ask you to tell me what is on the other side of the wall could you tell me?" "No."

"Why not?" "Because the wall is made of bricks, and **bricks are not transparent.** They are **opaque.**"

"Let me show you something else. Here I have two basins, one is made of glass, the other is made of the same stuff as mother's tea-cups and saucers. Do you know what that is?" "**Clay.**"

"Quite right. We may call it **a china basin.** Now I will put something into each basin without letting you see what it is. You shall try and tell me what I have got there. Let us look at the china basin first.

"Can you tell me what I put into the basin?" "No."

"Why not?" "Because we cannot see through the basin to find out what is inside it."

"What can you tell me about the basin then?" "It is **not transparent;** it is **opaque,** because we cannot see through it."

"Very good. Now I will get the glass basin.

"Can you tell me what I have inside this one?" "One of our red balls."

"How can you tell me that?" "Because we can see the ball through the glass basin. **Glass is transparent.**"

"Yes; you can see things as well through the glass as if there were no glass there at all. You saw at once that there was a round ball in the basin, and that the colour of the ball was red. If I take the ball out of the glass, you cannot see anything more than that.

"Here is just one other thing for you to think about. You told me that the light must shine in through the little windows of our eyes before we can see.

"What then can you tell me about those little windows?" "They must be transparent, like glass, to let the light shine through them."

"That is quite right. Those little windows, **the pupils of our eyes,** are made of something **as transparent as glass.**"

Lesson XIII

WATER

I. Water a Liquid

Commence by leading the children to think about their earlier lessons on water.

Starting with the rain, let them tell that it falls in little **ball-shaped drops**—*that it always* **falls down,** *never up—that the drops run together and* **make puddles of water** *on the ground—and that the water from the puddles* **flows down** *if it can to some lower part of the road. A few judiciously put questions ought to elicit all this from the children. It is old ground, over which they have travelled repeatedly.*

Refresh their memory on these points by simple and rapid *experiments with such things as are ready to hand—or, better still, call upon the children themselves to do what is required.*

Let them show how to break up water into round drops by shaking it from the end of a stick or a brush; let them collect the drops that fall on a slate, and watch them flow down the slate when it is held in a sloping position.

Let them show, with some sand or saw-dust, that it is an easy matter to pile these things up in a heap on the slate, and then that it is impossible to do this with water. **Water will not stand in a heap. It spreads out all over the slate.**

Stand a couple of tumblers on the table. Fill one of them half full of water, and pour some sand or saw-dust into the other. Call upon the children to tell what they observe in the two glasses. The sand (or saw-dust) **stands piled up in the middle of the glass. The water spreads itself out** *as far as it can, till the sides of the glass stop it. The water is really* **the same shape now as the glass itself.**

"Can you think of anything else, children, that would spread out and take the shape of the glass as water does?" "Milk, oil, tea, coffee, vinegar."

"Quite right, so they would. Now I want you to learn a new name. We call water **a liquid,** because it breaks up into drops; flows, and spreads about; and takes the shape of the thing into which we pour it.

"Say after me '**Water is a liquid,** and **milk, oil, tea, coffee,** and **vinegar are liquids too.**'"

II. IT IS TRANSPARENT

Place next a coloured marble in one of the empty tumblers. Hold it up before the children and proceed thus:—

"What have we in this tumbler?" "A marble."

"How do you know?" "**We can see it,** because **glass is transparent.**"

"Let us fill the glass with water. Can you see the marble now?" "Yes."

"I have a glass of milk here. I will put another marble into that. Can you see this marble through the milk?" "No."

On a bright, sunny day, with the sun shining into the room, a very striking little experiment may be shown by holding the glass of water in the direct rays of the sun. The children will readily see that the light passes through the glass and the water, for it dances about on the floor when the glass is moved. Try the same thing with the glass of milk. Show that this time we get only a dark shadow of the glass on the floor. The light does not pass through the milk as it did through the water.

"What have we learned?" **Water is transparent. Milk is not transparent**; it is **opaque.**"

"Why do you say water is transparent?" "Because **light passes through it,** and **we can see through it.**"

"Yes, water is so transparent that we can always see the bottom of the basin, tumbler, or cup which holds it, but we could not see through milk like this. We can even see the stones at the bottom of a stream, and the fishes swimming about in the water."

III. IT HAS NEITHER COLOUR, SMELL, NOR TASTE

While dealing with the property of transparency, lead the children to tell that **milk is white,** *and then show them that* **water is not white.** *It has* **no colour at all.**

Let them test the water and other liquids for taste and smell, and make them tell that, while they can smell and taste all the others, **water has no smell, no taste.**

IV. WHERE ALL THE WATER COMES FROM

Lastly, lead them to tell of the sources whence we get all the water we use. It all comes from the rain, and the rivers, and lakes which it forms.

"We, of course, use only a very little of all this water. What becomes of all the rest?" "It keeps flowing on **till it reaches the sea.** The sea is full of water. Many hundreds of great ships, much bigger than our school, sail over the sea from one place to another."

Lesson XIV

SOLIDS AND LIQUIDS

"WE are going to think about our tumbler of water again this morning, children. Here it is. The water you see fills the glass. It is the **same shape as the glass.**

"Let us pour the water out of the tumbler into this basin. Is it the shape of the tumbler now?" "No."

"What shape is it then?" "It is **the same shape as the basin** now."

Proceed in the same way to pour the water into other vessels in succession—e.g. *a jug, a bottle, a dish—and lead the children to tell that in each vessel the water takes* **a new shape,**—*the shape of the vessel itself.*

Now do the same with a few simple solid objects, e.g. *a ball, a cube of wood, a pencil, or a piece of brick or stone. Show that each of these stands up by itself at the bottom of the tumbler. It does not change its shape. It does not take the shape of the tumbler. When we take them out of the tumbler* **they all keep their own shapes** *whether they are put into the jug, the basin, or any other vessel.*

"We are now going to learn a new name for all those things which **have a shape of their own.** We shall learn to call them **solids.** The ball, the cube, the pencil, the stone are all solids. Each one of these things has its own shape."

Procure some ice from the fishmonger's shop. This can always be obtained without any difficulty.

Let one of the children take a piece of the ice and hold it in his hand, and lay another piece on the table. Then proceed to elicit from the children all they have to tell about the ice. It is water; but it is **not liquid,** *as we mostly see water.*

It is **a solid.** *Why? It stands up by itself, and does not spread about and flow over the table. We cannot pour it out as we could pour water. It has a shape of its own.*

It will now be time to attend to the child with the ice in his hand. Call attention to his hand. It is **very wet.** *Some* **water is falling** *from his hand to the floor* **in drops.**

Ask him what he has been doing to the ice. He has done nothing to it but held it in his hand as he was told. But the ice is all changing into water and running away through his fingers.

Leave him for the time being with the ice still in his hand, and turn to the piece which was stood on the table. The warmth of the room, by this time, will probably have melted some of the ice; the table will be wet now, and perhaps the water may be actually beginning already **to flow away** *in a little stream.*

When these things have been noted, turn to the child again.

"Give me your piece of ice, Fred. Why, it is all gone. What have you done with it?"

Tell that the ice has been **changed into water.** *We could not pick it up in our fingers now. When the boy first took it in his hand* **it was a solid**; *now it has been changed.* **It is a liquid.**

Remind them that the same thing has been going on with the piece of ice on the table, but not so quickly as in Fred's hand.

"What has changed Fred's piece of **solid** ice into **liquid** water?" "His warm hand changed the ice into water."

"Quite right. We say **the ice is melted.**

"The air of our room is warm; it is the warm air that has changed the ice on the table into water. **That has been melted too.**"

Put the piece of ice into a tin vessel of some sort, and stand it over the spirit-lamp. Call attention to the rapid change that now takes place. The ice **melts very quickly.** *It is all liquid now.*

Lead the children to tell that the air of the room was warm enough **to melt a little ice**; *Fred's hand was warmer,*

it melted more of it; *the flame of the lamp was so hot that it quickly* **melted the whole piece.**

"I will now show you something more about this melting, in a very pretty way. This is a piece of wax. I will put it into this big spoon and hold it over the flame of the lamp. Look at it as **it stands up in a lump** in the middle of the spoon. Is it liquid or solid?" "It is **solid.**"

Let the children watch it gradually fall away with the heat, and spread out, first forming **a little pool** *in the bottom of the spoon, and then* **gradually rising till it is full.** *Let them tell that it has taken the* **shape of the spoon.** *Tilt the spoon a little and show that the wax* **flows about** *now. We must be careful or we shall* **spill some of it.** *Stand the spoon, as it is, carefully aside for a while to cool.*

"You told me the wax was solid when we put it into the spoon. It was a lump of wax. I took it up in my fingers to put it into the spoon. It had a shape of its own.

"What first made it alter its shape?" "The **heat** of the flame."

"What did the heat do to the solid wax?" "It **melted the wax** into a liquid."

"What is it now—a liquid or a solid?" "A **liquid.**"

"Let us see whether it is."

Bring the spoon forward. If it is not quite cold, cool it by standing it in some cold water. When it is cold, turn it upside down. Let the children tell that it is not liquid now, or **it would flow** *out of the spoon. Remove the solid lump from the spoon, and show that it actually* **took the shape of the spoon** *when it melted.*

Lesson XV

SALT AND SUGAR

I. INTRODUCTION

SHOW a piece of common table salt and a piece of loaf sugar side by side. Lead the children to tell how they would find out which is the sugar, and which the salt. They would learn by tasting them. They could not find out by looking at them, for **both look white.** *They could not find out by feeling them, for* **both are rough, hard,** *and* **brittle.**

The brittleness of both may be shown by pounding them up into powder with a hammer; or by grating them into saucers with a nutmeg-grater. When this has been done, hand the saucers round, and let the children dip their fingers into each powder and taste it. They learn at once by the taste what each powder is. Remind them of the great use we make of both these things in our food and drink. They are good things for us to take. We want some of our food and drink to taste sweet; and we make it sweet with sugar. But we put salt into some of it, because we like it to taste salt.

"Let us try and find out how it is that salt and sugar are so useful to us."

II. BOTH DISSOLVE IN WATER

"I want two boys to come here and help me. There are two tumblers of water on the table. I will put some salt in one of them, and some sugar in the other. Here are two spoons. You shall stir up the water well in both the tumblers.

"Now pick out your piece of salt with the spoon, Harry." "I can't find it. I **can't see it** in the water."

"But you saw me put it in the water. Have you taken it out?" "No."

Deal in the same way with the sugar in the other tumbler. Then take a stone and drop that, so that all may see, into a third tumbler, and after stirring it well, call upon one of the children to take it out with his spoon. Of course he takes it out at once. Let it be replaced in the water and left there for the time.

"Now why can't we take the salt and the sugar out of the water, as we have taken the stone? Let us see.

"But we must first be sure that Harry has not played us a trick, and taken the salt and the sugar out."

Pour out a little of the salt water into a saucer. Let the children taste it, and they will at once tell that **the water tastes salt.** *Do the same with the sugar solution.* **It tastes sweet.** *Lead them to tell that before we put the salt and the sugar in, the water had no taste at all. Now one tastes salt, the other sweet. The salt and the sugar are still in the water,* **but we cannot see either of them.**

Let them taste some of the water in the tumbler in which the stone lies. Notice that the stone is still at the bottom, just as it was when we put it in. **This water has no taste.**

Let the children next dip the tip of one of their fingers into each saucer and put it to their tongue. They can taste the salt and the sugar **even in those little drops of the water.**

"Now what does all this show? I will tell you. It shows that there must be **some of the salt in every little drop of water** in this tumbler; there must be **some of the sugar in every little drop of water** in this one. But there is **nothing in the water where the stone is.**

"What has been done to the salt and the sugar then?" "The salt and the sugar must have been **broken up into very little pieces** in the water."

"Quite right; and remember that these pieces must be very very small indeed, because **we cannot see them in the water.** We only know they are in the water **when we taste it.**

"You must try now and remember a hard word which tells us all about this. When we break up the salt and sugar into little pieces in this way, by putting them into water, we say we **dissolve** them. The salt and sugar **do not melt** in the water; they **dissolve.**"

Remind the children that we **melted the wax and the ice** *when we held them over the flame of the lamp. We changed them from a solid to a liquid. But* **we did not put them into water** *to do it.*

Melt some sugar in a spoon over the lamp to show the difference. Point out that the sugar was solid when we put it into the spoon. **It now flows about. It is a liquid.** *We have* **melted** *it.* **The sugar in the water is dissolved,** *and so is the salt in the other tumbler. The stone remains just as it was.* **We cannot dissolve the stone** *in the water.*

III. HOW TO GET THE SALT AND SUGAR BACK AGAIN

Make a very strong solution of each, and put a little of it into a shallow evaporating dish over the flame of a spirit-lamp. It will be very interesting to the children to see the water pass away in vapour, and then learn, by tasting, that the salt and the sugar are left behind in the bottom of the dishes. They will then, moreover, have another proof that these things are actually in the water although they cannot be seen. **They are dissolved in the water.** Salt and sugar are useful to us because we can **dissolve** them.

LESSONS ON NATURAL PHENOMENA

Lesson XVI

A THUNDER-STORM

I. THE STORM COMING

COMMENCE *by interesting the children with a little word-picture of a very hot, sultry day in summer. The sky perhaps clear—*

the sun bright and hot—the air so still that there is not a breath of wind, and so close too that we can scarcely breathe. People seem too tired to walk about or work hard—little boys and girls may often be seen to fall asleep in school.

"Before such a hot, close day is over, **heavy rain** often comes, and with the rain **lightning** and **thunder.** We call it **a thunder-storm.** The rain does not fall steadily for hours as we sometimes see it. The storm **does not last long,** but it is **very fearful** while it rages, and sometimes does much harm.

"How does the sky look when the rain is falling steadily all day long?" "It is then a dull grey colour, not blue."

"Why?" "Because it is covered all over with rain clouds."

"Quite right. Now let us think of the sky when a thunder-storm is coming. If we watch the sky at such a time as this, we can see it change all of a sudden.

"It may have been bright and clear all day, but all at once **a cloud shows itself in one part of the sky.** Others come up after it very quickly, none of them very big; but they pile themselves up together into great masses, till they cover all that part of the sky.

"They are **very dense and black**—they make the sky look **the colour of ink**; and they make **everything dark** all round us; for they soon spread themselves all over the sky and **shut out the sun** altogether.

"Out in the fields **the air is quite still,** not a leaf moves on the trees. Even the birds seem to know what is coming; they are too frightened to sing; they fly away to get somewhere under cover before the storm bursts. The sheep in the fields huddle together frightened; the cattle move off, if they can, to some place of shelter, and we ourselves take care, if we are out, to get under cover too."

II. WHAT THE STORM IS LIKE

Picture the bursting of the storm. It may first show itself by a few very large, round drops of rain on the pavements and *road; but it generally begins with* **a sudden flash of lightning.** *Lead the children to think of the lightning—so* **sudden** *that* **the flash is gone** *as soon as we see it—so very, very* **bright** *that* **it seems to dazzle our eyes** *to look at it —so* **terrible** *that not only children, but men and women, and even the animals shrink away from it, and seem to hold their breath while the flash lasts.*

"Sometimes the lightning lights up the whole sky at every flash. We call this **sheet lightning.**

"Sometimes it seems to dart across the sky in zig-zag lines of dazzling light. We call this **forked lightning.**"

Lead them next to think of the thunder, which follows each flash of lightning. Sometimes the thunder comes very quickly after the flash. It is then close over our heads. Describe **the awful, crashing, rolling, crackling, rumbling sound** *that fills all the air. It is as if tons and tons of coal or stones were being shot out on the ground. No wonder the animals are terrified, when they hear that awful sound, directly after their eyes have been dazzled with the lightning. All the animals, that are able to do so, hide themselves up from the storm; horses often take fright in the streets and run away.*

Tell of the **danger of seeking shelter under a tree during a thunder-storm.** *The lightning often strikes trees, and if we were under a tree at such a time* **we should be killed in an instant.**

Not only children, but men and women too, have sometimes been foolish enough to stand under a tree to get shelter from the storm. The tree has been struck, and they have been killed.

"All this would be very dreadful even if there were only one flash and one roar. But while the storm lasts, which is sometimes an hour, there is **flash after flash,** and **peal after peal** every few minutes.

"All this time, too, the heavy **rain is pouring down** in such torrents that the streets and roads are soon covered with water, which **rushes along in streams** towards the lower part of the roadway. Why in that direction?"

III. After the Storm

Tell how the storm gradually ceases. The rain first begins to fall less heavily, and then ceases altogether—the lightning no longer flashes in the sky, and the thunder dies away in the distance—the clouds, which have been piled up dense and black, begin to break and roll away, so that the sun is no longer hidden, and patches of blue sky are seen everywhere. Soon (almost as quickly as they formed up at first) **the clouds roll away on all sides,** *so that nothing but* **the clear blue sky** *and* **the bright sun** *are seen. The pavements and roadways dry up with the hot sun, and all is fine again.*

Tell of the change everywhere after the storm. The air is **not hot, close,** *and* **sultry**; *but* **cool** *and* **fresh.** *The storm has cleared the air and* **made it pure.** *We can breathe this pure air now. We no longer feel lazy and unfit for work.*

Tell that even the little birds, when the storm is over, may be seen flitting through the air again, chirping and singing merrily—the sheep and cattle begin to wander about the fields once more, to crop the fresh grass. The very grass itself, and all the plants in the fields and gardens, look bright and fresh now that the storm is over.

Lesson XVII

A FROSTY DAY

I. Introduction

INTRODUCE the lesson with a chat about the run to school on a cold, winter morning. As soon as we step out of doors we feel the **sharp, biting air** *all round us. It makes our noses and ears and fingers tingle. We don't loiter on the way, but run briskly along to keep ourselves from getting cold. The ground feels hard as we run along, and it is* **slippery** *in some places. Mother, too, puts on our thick cloaks and coats to keep us warm,* *and we find nice blazing fires in school to warm the rooms. It is a* **cold, frosty morning**.

II. WHAT THE COLD DOES

Picture the puddles of water they saw in the road, as they went home the day before. Lead them to tell that in the morning they find them hard, and smooth, and slippery. They can stand on them. **The cold has changed the water into ice.** *They can break it up with their foot, and* **pick up pieces of it** *with their fingers.*

"Cold always changes the water into thick, hard ice like that. We say it **freezes the water.** The water is **frozen into ice.**

"It is sometimes so cold that the water freezes, as it drips down from the roof, and the window-sills. It then forms **long strings of ice,** which hang **like a fringe of glass spikes,** with their pointed ends downwards. They look very beautiful. We call them **icicles.**

"When the cold weather lasts a long time, it turns the water of the ponds and lakes into ice. The ice on the top of the water gets very thick and hard, so that **people can walk and run about on it.**

"What do we see people doing then?" "We see them **sliding and skating** on the ice."

"But the cold not only freezes the water of the ponds into hard ice. It does more than that."

Lead the children to think about the clouds. Let them tell what they are made of. Tell that the cold also **freezes this vapour of the clouds,** *and then it falls down and covers the ground, the trees, and the houses, like a white sheet.*

"Do you know what we call this **frozen vapour** that falls from the clouds?" "**Snow.**"

"You remember, too, that I told you there is always some of this vapour in the air all round us. We even send out vapour into the air every time we breathe, and so do all animals. We can see it on a cold, frosty day **coming from our mouths like a little cloud.**

"Vapour, too, is always rising up from the ground.

"The cold freezes this vapour in the air as well as that in the clouds.

"Think of the grass, the trees, and the tops of the palings, and tell me how they looked when you first came out in the morning." "They looked **white all over,** as if some one had **sprinkled them with snow.**"

"Yes, but it is not snow. It is the vapour of the air frozen into **tiny bits of hard ice** all over the blades of grass and the trees. We call it **frost.** If our eyes were sharp enough to see it properly, we should find that it looks very beautiful."

Remind the children of the appearance of the **window-panes** *in their bedrooms when they first get up on a frosty morning. They find them covered with all sorts of* **beautiful figures,** *just as if some one had been drawing* **pictures of hills, and trees, and clouds** *on the glass in the night. Tell that this too is the work of the frost. The vapour in the warm room became* **frozen on the cold glass** *of the window-panes, as soon as it touched them.*

III. How the Frost does its Work

Lead the children to think of the violence of the thunder-storm with its flashing lightning and its roaring thunder—of the force of the wind as it rushes on howling and whistling through the trees, making them sway to and fro, and sometimes even blowing them down—of the noise of the rain as it falls, sometimes in a shower, sometimes in torrents.

Tell that the frost does not go about its work like this. **It makes no noise.** *All through the night the air is still, the sky clear, the moon and stars are shining, and in the morning the sun rises bright, as if nothing had happened. We only know by what we see around us, that* **the frost has been at its silent work.**

IV. The Frost is very Useful

"Remember that a frosty day is not the time for boys and girls to sit crowding round the fire.

"The frost **clears the air,** and makes it **good for us to breathe.** A brisk run in the cold, frosty air really does us good, **makes us healthy, strong, and cheerful.** But we must not loiter about and get cold, or the frost will get at our fingers and toes and cause **painful chilblains** to come on them.

"The frost does much good to the **soil of our fields and gardens.** It breaks the hard lumps of earth, so that they crumble up into loose, rich soil, fit to feed the young plants next spring. It also **kills the insects** that live in the soil. Those insects would eat up the little plants if there were no frost to kill them."

Lesson XVIII

A SNOW-STORM

I. Introduction

"Do you remember our chat about the thunder-storm, children?

"What time of the year do those dreadful storms nearly always come?" "In the **hot, summer weather.**"

"Suppose we have a chat to-day about a storm of another kind that always comes in the cold, winter weather.

"I want you to picture to yourselves then a cold, frosty day. How would the trees and bushes and grass look?" "They would look **white.**"

"Why?" "Because they would be covered all over **with white frost.**"

"How would the roads feel as you ran along?" "**Very hard.**"

"Why?" "Because the **ground would be frozen.**"

"What would you see in the road?" "**Little sheets of ice.**"

"How would they get there?" "The **cold always freezes the puddles** in the road into hard ice."

II. SNOW—WHAT IT IS

Tell that on a day like this, if they looked up, they would see a **dull grey sky,** *with not a bit of blue anywhere. Let them say what this means. The sky is* **covered with dense clouds.** *It is very cold in the roads and fields, the air all round is very cold; it is* **very cold indeed up in the sky,** *where those clouds are floating about.*

Remind them of the nature of the cloud. Call up the picture of **the little cloud,** *that rose* **from the wet slate** *when we held it in front of the fire. Let them tell that* **it was like steam.**

"The clouds in the sky, then, are just like the little cloud that we made, and they float about there **because they are so light.**

"It is so cold up in the sky, where these clouds are floating, **that it freezes them.** Instead of being something like steam, as our little cloud was, they are now changed into **tiny pieces of loose snow.** These little pieces of snow **cannot float about** in the sky. They are **too heavy.** They fall to the ground, and we get **a snow-storm.**

III. THE SNOW-STORM

Lead the children to talk about the thunder-storm, with its rushing, pelting, torrents of rain, its flashes of lightning that dazzle our eyes and almost blind us, and its roaring, crashing thunder, that seems to make us deaf to every other sound around us. In the terrible thunder-storm everything seems upset. **It is all noise and bustle.**

Then help them to tell how the snow falls. It never falls in *round ball-shaped drops as the rain falls. It begins like* **little, loose white feathers,** *so light that* **they blow about** *everywhere in the wind. They do not fall straight down to the ground;* **the wind blows them in our faces** *as we walk along. These little loose white feathers of snow we call* **snow-flakes.** *The snow-flakes get larger as the storm goes on.*

"Now think of the rain, and the noise it makes. Even in a little shower we can hear it, as the drops fall pattering on the window-panes. In the thunder-storm the rain makes a great noise as it pours down.

"Can you hear the snow when it falls?" "No."

"In the snow-storm there is no noise, no bustle. **We cannot hear the loose white flakes,** when they fall on the ground or strike against the window-panes. It is **a very beautiful sight** to watch the falling snow."

Describe how the ground, trees, hedges, and house-tops, little by little become covered with the white snow. How beautiful it looks as it covers everything.

"What becomes of the rain when it falls on the ground?" "It flows away."

"Does the snow flow away?" "No."

"Why not?" "The rain flows away because it is water, and **water is a liquid. Snow is not a liquid.** It **cannot flow** about. It **lies where it falls.**"

"Then, if it lies where it falls, why does not the snow always remain on the ground?" "The sun shines out, and **its heat melts the snow into water.**"

"What becomes of it then?" "The water flows away, and the ground dries up."

Lead the children to tell how the beautiful white carpet of snow begins to look, when people and horses and carts walk over it.

Picture a heavy fall, when the snow lies very deep, and we have to sweep it into great heaps along the road-side, to make a path for people to walk along.

Picture, too, the great fun that boys and girls have **snow-balling** *one another. Most boys and girls are pleased to see the snow fall. They begin to think at once of their snow-balls.*

Tell that the deep snow, although it looks and feels cold itself, *really* **keeps the ground warm. It will not let the frost get down** *to freeze the soil and kill the plants that are left in it.*

LESSONS ABOUT MYSELF

Lesson XIX

THE BLOOD

I. Introduction

Commence with a little talk about plants as follows:—

"In our lesson the other day we peeled off pieces of the outside skin of the plant. What did we see then?" "Little **drops of water** all over the places that were cut."

"What did you find when you squeezed those green leaves in your hands?" "Our hands became wet."

"Where did the wet come from?" "It came **out of the leaves."**

"You called it water just now, Tom, and you see it is in the leaves, the stem, and all over the plant. How did the plant get it?" "The **roots sucked it up** from the soil."

"Then I suppose if we put the roots of our plants into basins of water, instead of putting them into the soil, they would grow just as well." "No; the plants would not live and grow in the water."

"Why not?" "Because they could not get their food out of the water."

"Where is the food that the plants want?" "In the soil."

"How does the plant get it?" "**The roots suck it up with the water.**"

"That is just what I wanted you to tell me at first.

So then, that water which you squeezed out of the plant had something in it that came from the soil?" "Yes."

"What did I say it was like?" "**The blood of the plant.**"

"Quite right. Now remember you too have **blood in all parts of your body.** What colour is it?" "It is **red.**"

"What else can you say about it?" "It is **warm.**"

"Right again; and you know that if your skin were torn, or cut, or scratched, **this red, warm blood would run out.**

"We are going to learn something to-day about this blood in our own bodies."

II. The Blood is in Pipes

"Look; I have here a tumbler of water. The first thing for you to learn is that the blood does not stand in our bodies as the water stands in this glass.

"Look on the back of your hand and you will see some blue lines stretching across it. Do you know what we call them?" "We call them **veins.**"

"If you could look close into these lines you would see what they really are. They are **hollow pipes,** and they are **always full of blood.**

"There are pipes like them in every part of the body. Some are **very much smaller** than these in your hand; some **very much bigger.**

"The largest pipe of all is about **as big round as your thumb.** The smallest pipes are so small, that **the finest hair** you ever saw would be **bigger round than they are.**

"But there is **blood in all of them,** from the biggest to the smallest."

III. The Blood Moves

Lead the children next to think of the water-pipes, that they have seen the men laying down under the roads. Let them tell *what is in them. What does the water do in the pipes? It flows along through them to our houses.*

"Now I want you to remember that **the blood** in those pipes all over your body **is always flowing**. It is never still. It never has been still. It never will be still while you are alive.

"The blood, that is now in that biggest pipe of all, will soon be flowing through those tiny pipes that are not so big as hairs. The blood that is now in *them* will be rushing through the big one."

Let the children place their fingers on the wrist and feel the "pulse." Tell them that the beating, which they can feel there, **is caused by the blood rushing through the pipes** *in the wrist to get to the hand.*

IV. Why the Blood moves

Show one of the children how to place his hand on the breast of another, just above the heart. Of course, say nothing about that organ yet.

Let him tell what he feels. He feels **a sort of beating** *there, like the beating he felt at the wrist.*

Explain that inside this part of our body, which we call the chest, there is something which causes this beating.

Show, if possible, a sheep's heart on a plate, not for the sake of experimenting with it, but merely to let the children see it. Tell what it is. It came out of the sheep's body.

We have a heart just like this one. It was the heart inside Harry's body that made the beating, which you felt just now. If you sit quite still, you will be able to feel your own hearts beat.

Tell the children to remember that their hearts are **about as big as their closed fists.** *Our hearts beat, and will never stop beating as long as we live.* **They are little pumps.** *They pump the blood along and make it flow through the pipes.*

Lesson XX

EATING AND DRINKING

I. INTRODUCTION

"WE are going once more to think about the growing plant and **the watery sap** inside it.

"How does the sap get into the plant?" "The roots suck it up from the soil."

"Why do the roots suck it up?" "It is **the plant's food.** The roots suck it up out of the soil **to feed the plant.**"

"What does the sap do for the plant?" "**It makes it grow.**"

"What did we learn to call the sap?" "**The blood of the plant.**"

"Now I want you to leave the plant, and think about your own bodies. You know **you have blood** in your bodies, and that this blood is always flowing along, so that it gets into every part of the body.

"Tell me again. What does the sap do for the plant?" "**It makes the plant grow.**"

"Do your bodies grow?" "Yes."

"Then remember that it is **the blood** that **makes your bodies grow,** just as it is the sap that makes the plant grow.

"What is it that makes the sap of the plant?" "**The food** which the roots suck in from the soil."

"Now I want you to remember that **our blood,** too, **is made from the food and drink** which we take."

Picture their meal on their plate at dinner-time, with the glass of water at the side of it; and then lead them to think of the blood which is flowing along, through those tiny pipes in the body. The **meat, bread, potatoes, cabbage, pudding, water**—*all go to make* **this wonderful blood.** *Picture,* *side by side, the great slice of pudding and one of those tiny hair-like pipes. But it must all go through the pipes.*

II. THE MOUTH AND ITS WORK

Lead the children themselves to tell all they can of the teeth, and the share they take in chewing up the food.

Cut a lemon up before them. It will be sure to "**make their mouths water.**" *Ask them to describe what they feel. Water streams into their mouths.*

Explain that this water is very useful while the food is being chewed. It makes the food soft and moist, so that **the tongue** *can easily* **roll it up into a ball.** *Always* **remember to eat slowly,** *because it gives the food longer time to be made moist and soft by this water in the mouth. It also helps the teeth* **in their grinding-up work.**

Describe next the act of swallowing the food. When it has been chewed long enough, so that it is well broken up and at the same time made soft and moist, **the tongue gathers it into a ball,** *and* **pushes it along towards the back of the mouth.**

III. THE GULLET AND STOMACH

Let the children feel the hard gristly rings of their own wind-pipe. Tell that this is **the breathing-pipe.** *It is the pipe along which the air flows when we breathe. We call it* **the wind-pipe.**

Tell that behind this is another pipe—we cannot see it—we cannot feel it—it is called **the gullet.** *The food has to go down the gullet when we swallow it.*

Sometimes silly boys and girls try to talk and eat at the same time. Tell that this always **shows very bad manners.** *We should never talk with our mouth full of food. Tell also that if we did, it is quite likely that some of the food* **would go down "the wrong way."** *Instead of passing into the gullet when we swallowed it, it would perhaps go* **into the breathing-pipe.** *If it did* **it would choke us.**

Describe next, in a simple way, **the stomach.** *It is only* **a large bag.** *Show its position. All the food must go down into the stomach. In the stomach it is rolled about from side to side for hours after we have eaten it; and the stomach, all that time, keeps pouring over it a sort of* **watery juice,** *like that which we find in our mouths. When the stomach has done its work, the food is not like it was when we swallowed it. It is now all broken up so fine that* **it can pass into those tiny little blood-pipes** *which we spoke about in the last lesson.*

Indeed the stomach **has changed the food into real blood,** *ready to be sent into those pipes.*

"Remember then that it is **the blood that feeds the body**; and it is **the food that feeds the blood.**"

Lesson XXI

BREATHING

I. INTRODUCTION

"OUR chat this morning is to be about the air, children. You know there is air all round us—there is air everywhere—we could not go into any place without finding air—and yet we have never seen it.

"How can you prove that there is air in this room?" "**We can feel the air** if we wave our hands about. We can feel it rush into our mouth and nostrils **when we breathe.**"

"What would happen if all the air could be taken out of this room now?" "We should die: **we could not live without air.**"

"Quite right. Without air we ourselves and every other living thing would die.

"I am going to show you now why we must all have air, and what the air does for us."

II. The Air-Pipes

Bring a child to the front, and instruct him to take a deep breath. Note carefully what happens. Call attention to the rising and falling of the chest during the act of breathing. The chest first swells up and gets larger, and then sinks down and becomes smaller. Let the children all stand, place the hand on the chest, and take a deep breath, so that they may feel this rising and falling for themselves.

"When does the chest rise and swell out larger?" "It rises and gets larger **when we breathe the air in.**"

"Then where do you think the air goes when we breathe it in?" "**Into the chest.**"

"Yes, it does; and the chest swells out when we breathe air into it, just as this bladder swells out when I blow air into it."

Illustrate, of course, with the bladder.

"Let us try now and find out more about this air—where it goes, and what it does."

Call attention to the mouth and nostrils. Lead the children to tell that behind the tongue is the throat—the food and drink pass down the throat when we swallow it. The nostrils run up through the nose, and then bend backwards towards the throat—the other ends of them open into the throat. In this way lead them to see that all the air we breathe, either through mouth or nostrils, must go into the throat.

Next lead them to talk about the act of swallowing the food. The food has to pass down the gullet or food-pipe into the stomach. The children themselves must tell all this.

"Why must we always be careful not to eat and talk at the same time?" "Because the food might **go down the wrong way,** and it would choke us if it did."

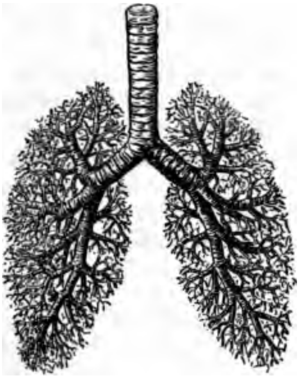
"What do you mean by saying the wrong way?" "It might go down **the breathing-pipe** instead of the food-pipe."

"Can you show me where your breathing-pipe is, Harry?

"What other name do we give it?" "We also call it **the wind-pipe.**"

"Quite right. All the air we breathe has to pass down, from the throat, through this **breathing-pipe** or **wind-pipe.**"

Trace the pipe downwards, and show that it passes into the chest. Tell, and show by a sketch on the black-board, that it splits *into* **two branches** *when it enters the chest. Each branch then splits up, again and again, till the little branches are only* **like hollow hairs. They are still air-pipes,** *and the air rushes down into them from the mouth and nostrils every time we breathe.*



III. The Lungs

Tell next of the lungs. There are two of them, with the heart between them. They fill all the chest. If a sheep's lights could be shown, so much the better. In any case tell the children to look at the sheep's lights, that hang in the butchers' shops. The teacher would, without question, find the actual things much more effective than any verbal description. She would find it very difficult to give these young children anything like a clear idea of the lungs without them. She need do nothing more than *show them on a dish, and let the children feel how soft they are, by pushing their fingers into them.*

"These are the lungs, then. The air-pipes, that we spoke of just now, spread out and fill every part of the lungs, so that **there is air everywhere through the lungs.**

"I want you next to think about the blood-pipes. You know there are blood-pipes in all parts of the body. There are **blood-pipes in the lungs.** They are **spread all round the air-pipes.**

"You must try now and remember that the air of those air-pipes is sucked into the blood in the other pipes. It is the **blood that wants the air. Without fresh air the blood would soon become bad.**

"Remember, too, that the blood not only takes in good air from the air-pipes, but **it sends out bad air into them.** It is this bad air from the blood that we breathe out."

LESSONS ABOUT ANIMALS THAT FLY

Lesson XXII

BIRDS—WINGS INSTEAD OF ARMS

I. INTRODUCTION

COMMENCE by leading the children to think about the walking and running animals. They all have four legs and feet. They use their legs in moving about from place to place. Wherever they go they have always got the hard, solid ground under their feet.

Then lead them on to consider the birds. They move about through the air from one place to another. While they move along they have no place to put their feet. There is nothing but air all round them—nothing for their feet to rest upon for a *moment. These animals do not use their feet in their movements through the air. They move by means of wings. We say they fly through the air with their wings. The children themselves could be easily made to tell all this by a few carefully-put questions.*

II. THE WINGS

"We are now going to leave the animals for a while. I want to talk about our own bodies. Come here, Fred. We will have another little lesson about you.

"How many limbs have you?" "**Four limbs.**"

"Show me them. What do you call them?" "**Two arms** and **two legs.**"

"We are going to think for a moment about your arms, now.

"What do we call this part where the arm is joined to the trunk?" "We call it **the shoulder.**"

"Stretch out your arm in a line with the shoulder. Now touch your face with one of your fingers.

"What had you to do before you could touch your face?" "I had to bend my arm."

"Show me where you bend it? What do we call this part of the arm?" "We call it **the elbow-joint.**"

"Quite right. The arm is in two parts, which are joined together by a joint at the elbow. The hand is placed at the end of the arm.

"What do we call the part that joins the hand to the arm?" "**The wrist.**"

"Now I want you to remember that birds, like boys and girls, have **four limbs**; but their **arms are changed into wings** for flying.

"Their wing has all the same parts as our arm, but the bones are longer.

"Look at this picture of the bones of our hand. Come and show me the finger-bones. Think of these **finger-bones** made **many times longer** than they are, and you will know what the bird's wing is like. When the thin skin is stretched across from one bony finger to another, **this long hand makes a wing,** for the bird to fly with in the air."

It would be well to sketch on the black-board the lengthened fingers of this hand-wing, and show the skin stretched between them.

Lead the children to describe the flapping movements of the wings up and down in the act of flying, and let them illustrate these movements with their own arms. The bird stretches its wings out wide to fly. When it settles on a tree or on the ground, it folds its wings up close to its body.

III. Light, Hollow Bones

Lead the children next to try to picture to themselves one of the walking animals—a horse, a cow, a dog, or even a cat, or a rabbit—with wings. Could they fly?

Tell of their heavy bodies—their thick, solid, heavy bones. Show one or two bones. Let the children handle them for themselves.

Tell that the bird's bones are not thick and solid like these. They are **very thin** *and* **very light.** *At the same time they are* **hollow.**

All this makes the body of the bird **very much lighter** *than the bodies of other animals; and it is able to raise itself in the air, and fly with its wings.*

The difference might be made very striking to the children, by letting them hold some small animal in one hand and a bird in the other.

Lesson XXIII

BIRDS—THEIR LEGS AND FEET

I. Introduction

Introduce the new lesson with a little chat about birds as flying animals. Most birds use this one way of moving about from place to place. In these flying movements they want only their wings.

But birds are not always on the wing. They have to settle and rest from time to time. It is then that they want their other pair of limbs—their legs.

Lead the children to tell from their own observation, as far as they can, how birds move about on the ground, the teacher assisting where they fail. The sparrow takes **little, short hops**; *it cannot walk on the ground. The cocks and hens* **walk about** *as boys and girls do.*

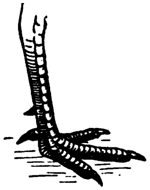
"Where do most birds like to settle and rest?" "**On the branches** of the trees."

"Could we stand on the branch of a tree and go to sleep there?" "No; our feet would only stand flat on the branch, and if we tried to rest or go to sleep we should fall."

"The feet of the bird are made **to clasp the branch.** They hold on tight so that it cannot fall."

II. What the Feet are like

Show the leg and foot of a fowl. Let the children examine it. It is not at all like the legs of any of the walking animals. If they feel it, they will find that it is **hard** *and* **bony**; *there is* **very little flesh** *to cover the bones.*



The skin of the leg, too, should be carefully examined. Show that it is made of **thick, hard scales.** *Tell that this is only the lower part*[1] *of the leg. Show the joint by which it was joined to the part above. That part is covered with feathers, and not with horny scales like the lower part.*

Call attention to the foot. It has **four toes—three in front** *and* **one behind.** *Each toe has a strong claw (like our finger-nail) at the end of it. The claws of some birds are very long and sharp. Tell that the toes of most birds are like this one.*

---

[1] Properly speaking, this is not the actual leg-bone at all; but the tarsus. In birds we always find the thigh-bone and the two leg-bones, just as in mammals. The lower end of the leg-bone carries, not seven tarsus bones, but a single one. This is the bone which is commonly looked upon as the bone of the lower-leg.

Remind the children once more that the bird's feet clasp the branch easily, but we could not "hold on" with our feet.

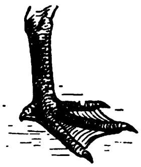
"Could we 'hold on' better with our hands than with our feet?" "Yes."

"Why?" "Because our **fingers are longer** than our toes, and we can easily bend them. They would clasp the branch."

"Now look at this foot of the fowl. The **toes are long,** and when I pull this cord in the leg I make them bend, just as we bend our fingers when we shut our hand. The bird can clasp the branch **by bending its toes.**"

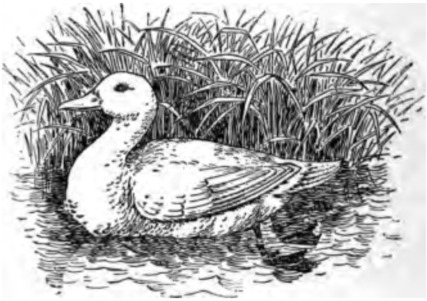
Lead the children to tell that the fowls always go to roost at night, sleeping on their perches, just as little birds do in their cages.

III. The Webbed Foot



Show next a duck's foot. Without inquiring what bird it belongs to, let the children examine it, and point out what they find new in it. There are the same four toes—three in front and one behind, but **the toes are joined together with a thick, strong, yellow skin,** *which we call* **a web.** *Let them feel how tough this web is.*

Lead them to see that such a foot would not be a good one to clasp the branch of a tree. The web between the toes would not let them bend far enough. Birds with those



feet then **do not perch** *like the fowls do. Show a picture of a duck swimming in the water. Tell that the duck can swim because it has these webbed feet. Only those birds whose feet have a* **web between the toes** *are able to swim.*

Lesson XXIV

ANOTHER CHAT ABOUT BIRDS

I. Introduction

Recapitulate briefly the main facts of the preceding lessons with a view to making the children tell (as far as they have learned them) the points which divide birds from other animals.

Deal specially with the birds as flying animals. Lead the children to tell how necessary it is that the body should be light, and how this is secured in the build of the bird. This will naturally lead up to a talk about the kind of clothing with which all birds are provided.

II. Feathers for Clothing

Commence with a few words about the walking animals. Some are clothed with coats of shaggy hair, some with thick coats of wool, and some with soft, smooth, fur coats. These coats keep the animals warm; they are the best coats they could have. But we never see a bird with a coat of this kind. Make the children themselves tell why. These coats are warm, but they are very heavy. A boy's winter overcoat keeps him warm, but he is much heavier, when he has got it on, than he is without it.

"The birds must have a warm covering for their bodies, too, for like the other animals, they live out in the open air all through the year.

"But besides being warm, what else must the covering be?" "It must be **very light,** or the birds **will not be able to fly** in the air."

"I have some feathers in this basket. Come here, Mary, and thrust your hand in amongst them. How do they feel?" "**They feel warm.**"

"Take as many as you can in your hand and hold them up.

"Do they feel heavy or light?" "They are **very light indeed.**"

"Do you know anything so light as they are?" "No."

"You are quite right. When we want to say that something is very light indeed, we often say it is almost as light as a feather, because feathers are really **the lightest things we know.**

"But feathers are not only very light; they are very warm too. That is why birds always have a covering of feathers for their bodies."

Show, if possible, a bird of some kind, either a live bird in a cage or a stuffed specimen.

Point out the covering of feathers all over its body. Let the children stroke the feathers the right way with their fingers, and lead them to tell how **soft, smooth,** *and* **glossy** *they are, and how* **close they are set** *all over the body, one* **lapping over** *the other.*

Let the children see which is the right way—from the head to the tail of the bird. Which way does the bird move through the air? **Always forward,** *never backward. Ruffle the feathers up the other way, and show that, if the bird flew backwards, its feathers would be always ruffled up. As it always flies head foremost, its feathers are pressed close to its body.*

Show lastly that not only is its body covered with feathers, but its **wings and tail too are made of large feathers.** *These large feathers of the wings and tail help the bird to fly.*

III. BEAKS FOR MOUTHS

Return once more to consider the walking animals. Lead the class to think, for a minute or two, about the mouths and teeth of these animals.

"Let us think first of all about our own mouths.

"What are the doors of our mouths made of?" "Soft flesh."

"What do we call them?" "The **lips.**"

"What have we inside the lips?" "The **teeth.**"

"Now think of all the walking animals you know.

"What kind of doors have they for their mouths?" "They have **lips** too."

"What have they inside their lips?" "They have **teeth** just as we have."

"Now look at our bird. Has the bird a pair of lips too?" "No, the bird has **a hard beak,** and no lips at all."

"Quite right. All birds have these hard beaks. They are made of the same **hard, horny stuff** as our nails are made of; but they are **very thick** and **hard** and **strong.**"

Show the head of a fowl with its hard, strong beak.

"Do you know why birds always have these hard, horny beaks? I will tell you. Their beaks have to do for teeth; for **birds have no teeth** such as you have."

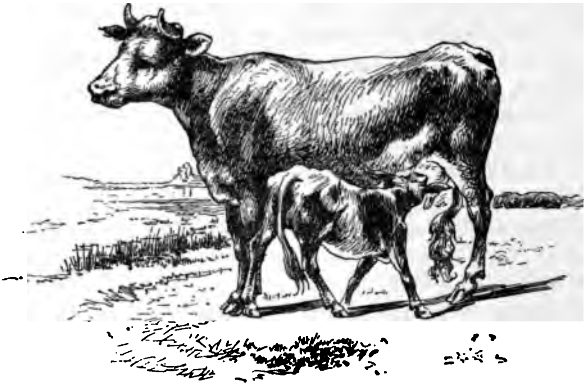
Lesson XXV

A BIRD'S NEST

I. INTRODUCTION

"Do you know, children, what the cow's baby is called?" "**A calf.**"

"Boys and girls in the country often see the cow feeding her baby in the fields. Do you know how she does it? I will tell you. She gives it **milk from her own body.** The sheep feeds her little lambs in the same way; and the horse, the donkey, the cat, the dog, and all the walking animals **suckle their little ones** too.



"**Birds never do this.** We are going to have a chat now about the way in which birds bring up their young ones."

II. Birds lay Eggs

Show an ordinary hen's egg. Let the children tell what it is, and where it came from. The hen laid it in the fowls' house.

A small collection of other eggs, and a nest of some sort, should be got together, if possible, and kept in the school museum. Perhaps no other thing in the museum would afford so much intense interest to the children as these. The collection might include large eggs from geese, ducks, fowls, and pigeons, as well as the eggs of smaller birds. They should all be pricked and blown, and kept in a place of their own in the cupboard.

Show the eggs, or as many as can be obtained, and proceed thus:—

"All birds lay eggs like these. When they have laid as many as they want, **they sit upon them** for a long time. Their warm bodies, with their warm covering of feathers, **keep the eggs warm**; and, at last, the egg-shells burst open, and **little birds come out of them.** This is why the mother bird laid her eggs."

Tell that when the little birds first come out of the eggs they are mostly very weak, and have no nice warm feathers to cover them and keep them warm. The mother has to take care of them for a long time. This will naturally lead up to the nests which birds build for their eggs.

III. THE NEST

Show a specimen nest if possible. Call attention to its shape. As a rule it is made **round, broad,** *and* **not very deep**—*something like a shallow* **basin.**

Lead the children to see the purpose of this. When the bird lays her eggs in this basin, they lie close together at the bottom, and do not roll about as they would if the nest were flat like the top of the table. The bird, too, can cover the eggs with her body easily in this round basin, and so keep them warm all the time she is sitting upon them.

"All birds **do not make the same kind of nests.** They do not all make their nests with the same things. But I want you to remember that a hundred birds of the same sort would **always build in one way.** A robin never builds the same kind of nest as a lark; a swallow's nest is never like the nest of a blackbird.

"Birds use all sorts of things for building, such as the twigs of trees, straw, grass, moss, wool, hair, leaves—anything they can pick up in the fields. Some birds make their nests with mud which they get from the sides of ponds and ditches.

"The mother bird seems to know beforehand what her little ones will be like when they first come out of the egg-shell. Some little birds, as I told you, are very weak, and have hardly any feathers to cover them.

"The mother then not only makes a nice warm nest of moss, hair, and wool, but she even **strips off some of the feathers from her own body** to line the nest, before she lays her eggs in it.

"Did you ever see little chickens, or ducklings, just out of the shell? **They are not weak** like some birds.

They can **run about**, and the **little feathers** can be seen **all over their bodies.**

"The mother bird seems to know this, for the only thing she does is to **make a hollow in a heap of straw** and lay her eggs in it. That is the only nest she ever makes."

IV. The Little Birds

Lead the children, lastly, to think of the little newly-hatched birds. They must be fed, **but the mother has no milk to give them.** *Picture the hen and her chickens. Tell how she scratches about in the ground to find food for them, and clucks to call them to the feast. Picture the little ones running, as she calls them to pick up the dainty morsel.*

But some little birds in the nests are too weak to do this. Tell how the mother bird and her mate, in this case, fly about from place to place, to find food for them. Picture them **bringing worms,** *and anything they can find, in their beaks* **to feed the hungry little mouths** *in the nest.*

After a time the little ones get strong enough to leave the nest, and then comes more work for the old birds, for they must **teach them to fly.** *Picture them again at this work, and show what great care even these little creatures take of their young ones.*

SOME OTHER ANIMALS THAT FLY

Lesson XXVI

THE BAT

I. INTRODUCTION

COMMENCE with a short chat about the wings of birds. Let the children themselves tell all they can of the nature of the wing, and the use these creatures make of it in their movements through the air. The wing is really a great hand, with the bones of the fingers and thumb grown very long indeed.

After preparing the way thus far, show a picture of the bat, and proceed with the lesson as follows:—

"I want you to have a good look at this picture. It is a picture of a very strange animal. Let us try and find out what we can about it."

II. WINGS FOR FLYING

"First of all we can see it has **a pair of wings;** so it is like a bird, for all birds have wings.

"Tell me again what use birds make of their wings." "They use them for flying through the air."

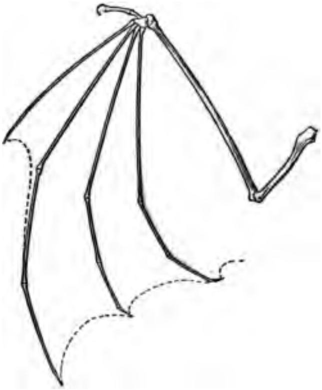
"Then as the bat has wings, how would you expect it to use them?" "For flying through the air, just as the bird does."

"Quite right; and so it does. The first thing I want you to learn is that **the bat is one of the flying animals. It is like a bird, because it has wings and can fly.**"

III. A FUR COAT INSTEAD OF FEATHERS

"Now look at the picture again. What sort of covering has the body of the bat?" "It looks like hair."

"Yes, its body is covered **with a coat of thick, smooth hair, or fur.** There are no feathers of any kind on its body."



Show a bird's wing of some sort. Notice that the wing itself is made of long feathers, one lapping over the other.

Call attention to the wing of the bat in the picture. Lead the children to tell that there are no feathers of any kind in this wing. The wing is made of **a thin skin, or web, stretched between the long fingers.**

The thumb and finger bones may be very clearly seen in the bat's wing. Point them out—the thumb short, the middle finger very long, often longer than the head and body together. Show how the thumb nail curves round and forms a sort of hook. Tell that the animal uses this hook for clinging to the trees when it alights.

IV. MOUTH AND TEETH INSTEAD OF A BEAK

Let the children next think about the heads of birds, and tell all they can about them. All birds have hard, horny beaks, not at all like the mouths of other animals. They have no teeth; their strong beaks serve instead of teeth.

"Now look at the picture of the bat once more. The first thing we notice is that the head, like the rest of the body, is **covered with hair**; and is **something like the head of a mouse or a rat** in shape. It has **no hard, horny beak,** but **lips** like those of the walking animals, and **two rows of teeth** inside the mouth. The bat is not like the bird then; it has a **mouth and teeth, not a hard beak.**

"Let us have one more look at the bat's head."

Call attention to the large, wide-open ears, that stand up on the top of its head. Lead the children to tell that we never see ears on the head of the bird. The covering of feathers makes the head smooth and round all over.

Turn, lastly, to the animal's arms and legs. Show that both are covered with hair, like the rest of the body. The feet are **not like birds' claws.** *They are more like the feet of some of the walking animals. They have long toes,* **for clinging to the branches** *of the trees.*

"If you could see the bat without its great hand-wing, what kind of animal would you expect to find it?" "**A walking animal.**"

"Yes, it is like the walking animals in everything but its wings. It has wings because it is meant to fly. **It is a flying animal.**"

Lesson XXVII

THE BUTTERFLY

I. Introduction

"I WANT to talk to you to-day, children, about some other animals that fly. They are not at all like the flying animals we have talked about in our lessons. They are little things. We can often see them flying about from flower to flower, when the weather is fine and warm. Boys and girls sometimes think it fun to chase them, and knock them down with their hats. But this is thoughtless and cruel.

"Do you know the name of the little animal I mean?"

"The butterfly."

"Yes, **the butterfly is a flying animal**; we know that it flies about, but it is not like the birds, and it is not like the bats.

"Let us see what we can learn about this strange little animal. I want you to learn from the little thing itself. But as you could not handle a live one without hurting it, I have got some dead ones to show you."

A few good specimens of butterflies might be easily obtained during the summer time, and, with a little care, pinned out on a sheet of card-board.

II. An Insect

Show the specimens on the card. The children will at once recognise the common creamy-white butterfly (the cabbage butterfly). Point out the other specimens one by one. They are all butterflies; some are very beautiful. Call attention first to the *form of the body. It is* **long and narrow,** *and* **covered with fine, short hairs,** *that give it a soft, downy look.*

Point out the head. Show where the head is joined to the chest, and then show that there is another part behind the chest. **The body is in three parts.**

"You see the body of the butterfly looks to be almost **cut through in two places**—between the head and the chest, and again between the chest and the lower part.

"It is because of this that we call the butterfly an **insect.** The name **insect** means **cut into parts**; and it always calls up in our minds that **the body** of the little creature **is in three parts,** as if it were nearly cut through."

Lead the children, themselves, to name insects of many sorts that are always flying about in the air; gnats, flies of all kinds, butterflies, and moths, the honey-bee, the wasp—all are insects. All of them have bodies in three parts. Actual specimens of as many varieties of insects as possible should be collected, and pinned to a sheet of card-board for illustration.

"If we took one of them in our hands, it would **feel very light.** We could hold hundreds of them without feeling the least weight. All the insects are very small; some are so tiny that our eyes are not sharp enough to see them properly.

"They are all of them unlike the other animals we have seen. They have **no bones in their bodies,** and **no warm blood.** Their bodies are cold."

III. WINGS

Take the wings next. Tell that the butterfly has **two pairs of wings.** *Most insects have two pairs of wings.*

Call attention to one of the specimens on the card, in which the wings are outspread, **as in the act of flight.** *The two wings on either side of the body are plainly seen. Then turn to another specimen with the* **wings folded together vertically.** *This is the position in which we always see a butterfly when it settles on a leaf or a flower.*

Show the beautiful markings of their wings. If we look very close, we shall find that the wings are **covered with scales.** *When cruel boys chase the little things, the scales of the wings rub off like powder, as soon as they touch them. These scales are very beautiful, if we could see them properly.*

IV. Legs

"Now let us look at the legs, and see what we can learn about them.

"How many legs has a bird?" "Two legs."

"How many have the walking animals?" "Two."

"How many has a bat?" "Two."

"Here we have a little animal, very much smaller than any others we have seen, but **it has six legs**—three on each side of its body. **All insects** are like the butterfly, and **have six legs.**

"The legs and wings of insects are joined to **the middle part of the body.**"

V. The Butterfly's Food

Remind the children that the butterfly is always flying about from flower to flower. Why should it do this? It is seeking its food. Tell of the long **sucker** *or* **tongue,** *with which it* *sucks up* **the juices of the flowers.** *This is the* **butterfly's food.**

"Just think now for a moment about the bat. It looks like a walking animal, but it has wings, and it can fly. It is a flying animal. It is made to fly only because **it feeds upon the insects that live in the air.** It catches them as it flies about."

LEARNING TO TELL THE TIME

Lesson XXVIII

A DAY

COMMENCE by leading the children to tell all they know about the sun. Let the questions elicit from them that the sun shines in the sky and gives us light and heat—that it is not always shining on us—that it begins to shine in the morning, and goes away in the evening. We say **the sun rises in the morning,** *and* **sets in the evening.** *It always rises in one part of the sky, which we call* **the east,** *and sets in another part of the sky, which we call* **the west.**

Show that from the time the sun rises in the east, to the time it sets in the west, **it has moved right across the sky.** *All this time it has been giving us light and warmth.*

Tell that this is the time when men and women do their work, and boys and girls go to school. We call it the day-time.

"What happens after the sun has set?" "It begins to get dark."

"Why?" "Because the sun is not shining on us."

"What else happens because the sun is no longer shining?" "It gets colder than it was in the day-time."

"How long is it dark and cold like this?" "Till the sun rises the next morning."

"What do we call all this time?" "We call it the night."

"Now I want you to look out for the sun each day, when you go home from school to dinner. You will always find it in the same part of the sky. It is **higher in the sky** then than it is at any other time.

"We say **it is noon,** and **noon** means **the middle of the day.**

"Instead of saying the middle of the day, we often give it a shorter name, and call it **mid-day.**"

Show that at noon or mid-day the sun has travelled just **half-way across the sky.** *It rises in the east in the morning, and mounts higher and higher in the sky till noon. After that it travels down the other side of the sky towards the west, where it sets.*

"Can you tell me what you call that part of the day when you come back to school after dinner?" "We call it the **afternoon.**"

"Now think of this word **after-noon.** What does it mean?" "It means **after the noon is over.**"

"Of course it does, just as **after-dinner** means **after dinner is over**; and what do you say noon means?" "The middle of the day or mid-day."

"Then if afternoon means after the middle of the day, what name shall we give to all that time which comes before the middle of the day?" "We might call that **before noon.**"

Explain that we do not say this, but we use a shorter name and call it **forenoon,** *which means the same.*

"Now think of the sun as you saw it in the sky at noon to-day, when you went home to dinner. When will you see it in exactly the same part of the sky again?" "When we go home to dinner at noon to-morrow."

"Quite right; and I want you to remember that all this time the sun is travelling. We can see it in the afternoon as it moves across the sky towards the west. We lose sight of it after it sets; but it is still travelling. In the morning it will **rise in the east,** so that we can see it again, and all the forenoon it will **mount up higher and higher in the sky till noon or mid-day.**

"You must try and remember that this journey of the sun from noon to noon again takes up exactly one day.

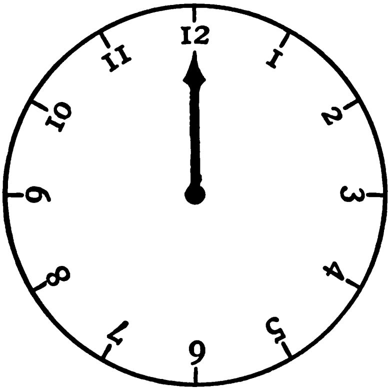
"I have already shown you how we can divide this day up into **afternoon, evening, night, morning, forenoon.** But this would not be enough, and so we divide it up into **twenty-four parts,** all the same length.

"These we call **twenty-four hours,** and we say that **twenty-four hours make one day.**

"If you look round the room you will see something that will tell you about these hours of the day. Do you know what I mean?" "The clock."

"Quite right. **The clock points out the hours** of the day. Let us see if we can learn something now about the clock."

Produce the card-board clock-face, first removing both the hands. Let the children tell that the face is **a circle,** *just like the face of the clock which hangs on the wall. Show that the edge of the circle*—**the circumference**—*is divided into* **twelve parts,** *all the same length. Let the children count the numbers round the circumference*—1, 2, 3, 4, *and so on up to* 12. *Tell that these twelve numbers* **mean twelve hours.**



Next produce the shorter of the two card-board hands. Fix it in its proper position, and show that we can then move it round the clock-face, so as to make it point to each of the numbers, one after another.

Explain that, because it points out the numbers in this way, **we call it a hand.** *We point out things with our own hands.*

Set the hand, to begin with, on the 12, *and lead the children to tell that* **it is pointing to 12 o'clock.** *Tell that* 12 *o'clock means simply* **12 on the clock.** *What time is it always on the clock when they go home to dinner? This will lead them to see that* **noon, middle of the day, mid-day,** *and* **12 o'clock** *all mean the same thing. Now move the hand slowly round to the figure* 1. *Tell that from* 12 *to* 1 *on the clock-face means one hour, from* 1 *to* 2 *means one hour, and so on, all round, till the hand gets back to* 12 *again.*

"If I place the hand at 12, and move it round the clock-face till it comes back to 12 again, how many hours will it have pointed out?" "**Twelve hours.**"

"Now suppose we move the hand round once more. That means another twelve hours. It has now pointed out twelve hours and twelve hours. How many hours is that altogether?" "**Twenty-four hours.**"

"Quite right; and now I think you will understand it all. The sun **takes a whole day** to make its long journey[1] from noon to noon. We divide this day up into **twenty-four hours.** The clock-face has **twelve hours marked on it,** and so the hand has to travel **twice round the clock in one day.**

"Our next lesson will teach us some more about the clock."

Lesson XXIX

HOURS AND HALF-HOURS

Introduce the clock-face with only the single hand, as used in the last lesson; and commence as follows:—

---

[1] *N.B.*—The fact that it is the earth which actually moves, and not the sun, must be passed over for the present. Children learn by what they see. They see the sun in different parts of the heavens in the course of the day, and it will be quite sufficient, at this stage, for them to regard it as travelling from one point to another across the sky. Further explanation just now would only tend to confuse their ideas altogether.

"What is this, children?" "It is a clock-face, like the clock which is hanging on the wall."

"What do these numbers on the clock-face tell us?" "They tell us the hours of the day."

"How many numbers can you see?" "Twelve numbers."

"How many hours do they tell?" "Twelve hours."

"How many hours are there in the day?" "Twenty-four hours."

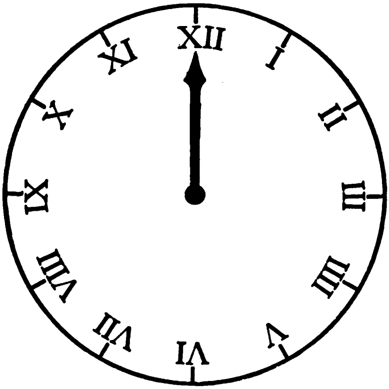
"How many twelves make twenty-four?" "Two twelves."

"Then how can the clock-face tell all the twenty-four hours of the day?" "**The hand has to travel twice round the clock in the twenty-four hours.**"

"I am going now to move the hand about, and I want you to tell me what hour it points out each time."

The children may be very profitably exercised on this step, till they are quite familiar with the position of the twelve numbers round the dial.

After this it would be well to introduce the other clock-face,



in which the Roman numerals are used instead of the Arabic figures. This should be followed by another exercise with the *hand, in order to familiarise the children with the new numbers and their positions.*

Have each case of difficulty set right, by letting the children refer to the old numerals on the original dial. Plenty of practice will soon clear away all trouble in this respect. Proceed as follows:—

"The hand, you see, tells us when it is one o'clock, two o'clock, three o'clock, ten o'clock, and so on, all round the face.

"Come and put the hand where it will point out four o'clock, Harry.

"Now show me how far you would have to move it to make it point out five o'clock. Quite right. And what length of time is it from four o'clock to five o'clock?" "**One hour.**"

"Then what length of time does this distance between IV and V on the clock-face show?" "**One hour.**"

"Now I want you all to notice what I do next."

Place the hand so that it points just mid-way between IV and V.

"The hand this time, you see, is not pointing either to the IV or the V, but just half-way between them. When it moves all the way across from one number to another, what length of time does it tell?" "One hour."

"Then what must it tell when it has moved only half-way across?" "**Just half an hour.**"

"Quite right; and we might say that it points now to **half an hour after four.** We do not say all this. We say it points to **half-past four**; but it means the same thing.

"Our clock up there tells us all this, and much more, but in a better way. Look at the clock, and see if you can find anything there that you do not find in our clock face." "**The clock has two hands**; this clock-face has only one."

"Quite true. Now look again. Are the two hands of the clock alike?" "No, **one hand is long, the other short.**"

Tell that all clocks have a long hand and a short one. The short hand points out the hours. We call it **the hour-hand.**

"Come and point the hand of our clock-face to the number IV again, Harry. What does this hand show now?" "It shows the hour."

"What hour?" "Four o'clock."

"What shall we call it then?" "The hour-hand."

"Now I am going to fix another hand on our clock-face.

"Must it be longer or shorter than this one?" "Longer."

Fix it up, and place it so that it points to the twelve. Call the attention of the children to the position of the two hands. Let them tell again that the short hand pointing to the IV means four o'clock.

"Now look carefully at the long hand. This is the very first thing I want you to remember about it. Whenever the short hand of the clock points to any of these numbers, **the long hand will be,** where this one is now, **on the XII.**"

"What does the short hand tell us by pointing to the IV?" "It tells us that it is four o'clock."

"Where is the long hand?" "It is on the XII."

Tell that some clocks let us know the hours in a very pretty way. There is a bell inside, and the moment the long hand points to the XII, and the hour-hand to the number, **this bell strikes.** *We know the hour* **by counting the number of times the bell strikes;** *and we do not want to look at the clock at all. Show this on a small striking clock if possible.*

Follow up now by a brisk exercise in pointing out the hours with both hands of the clock-face—one o'clock, two o'clock, three o'clock, and so on. If this is carefully done, it will be an easy step to show the children that the long hand each time travels all round the face, **while the hour-hand moves only from one number to the next.**

This done, have the hands set again for four o'clock, and then move the hour-hand half-way between the IV and V as we had it before.

"What time does the hour-hand show now?" "**Half-past four.**"

"Why?" "Because it is just half-way between the IV and V."

"Suppose we had moved it all the way across to the V, how far should we have had to move the long hand?" "**All round the face.**"

"Then as the hour-hand only moved half-way across, how far do you think the long hand ought to move?" "**Half-way round the face.**"

"Come and move it half-way round, Fred. What figure is it pointing to now?" "It is pointing to VI."

"And what time does the clock-face show?" Half-past-four."

"This is the second thing I want you to remember about the long hand. **It always tells the half-hours when it points to the VI at the bottom of the clock-face.**"

Lesson XXX

MINUTES

Commence with a brief recapitulation of the last lesson in some such way as this:—

"We are going to have another chat about our clock-face to-day, children. Let us begin with the hands. In the first place, why do we call them hands?" "Because they point out the numbers on the clock-face, just as we point out things with our hands."

"What name do we give to the short hand?" "We call it the hour-hand."

"Why?" "Because it points to the hours."

"How does the long hand help the other in pointing out the hours?" "It always points to the XII for every hour."

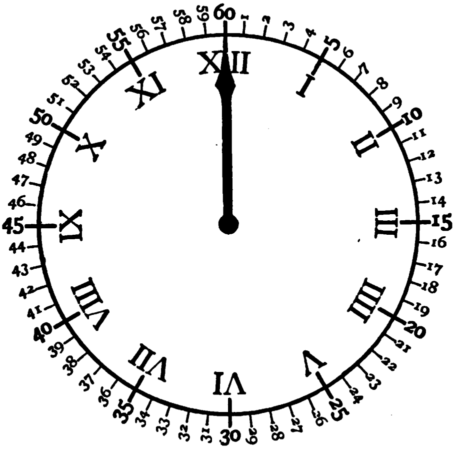
"How far does it travel while the hour-hand moves from one number to the next?" **"It goes all round the clock, from XII back to XII again."**

"Can you tell me how the long hand helps to show the half-hours?" "When the hour-hand is half-way between two numbers, the long hand always points to VI. **It is then half-way round the clock, and tells the half-hour."**

"We are now going to learn something more about this long hand. I will begin by showing you another clock-face. You see, I have only one hand on this face. Which is it?" "The long hand."

"I want you to look carefully at the face itself. Do you see anything on it that you did not see on the other?" "There are a great many little numbers round it."

Point out that these numbers **begin with 1 and end with 60.** *The clock face is* **divided into 60 parts,** *all the same length. Number* 1 *comes directly after the XII, and number* 60 *is just on the XII.*



"I must tell you what all this means. But before I do so, I want you to tell me once more, how long it takes this long hand to go all round the clock, from XII back to XII again." "It takes one hour."

"Quite right; and you may now learn that there are **60 minutes in an hour.** As you know that, I daresay you can tell me **why I have divided the clock-face into 60 equal parts?**" "To show the 60 minutes."

"Of course. Each little space between these figures stands for **a minute.** There are 60 minutes altogether.

"Now I think you may learn the proper name of this long hand. We call it **the minute-hand,** because it has to point out the minutes, just as the other is called the hour-hand, because it has to point out the hours."

"We will now look at the figures themselves once more. Where does the figure 5 stand?" "**Just over the I,** which means one o'clock."

"You notice that I have made that figure larger than the others. What is the next large figure?" "Ten."

"Where does that stand?" "Just on the spot **which means two o'clock**"

"What is the next?" "Fifteen."

"Where does that stand?" "**Where the figure for three o'clock is placed.**"

Follow up with the other figures, 20, 25, 30, *in the same way, and show that each is placed at one of the hour numerals.*

"How many minutes are there in the whole hour?" "Sixty minutes."

"Then what shall we call **thirty minutes?**" "Half an hour."

"Where does the long hand point to show the half-hours?" "At the figure VI."

"Tell me the minute figure which stands at the VI?" "Thirty."

"Now let us think of our last lesson. Where does the minute-hand point, at every hour?" "It points **to the figure XII.**"

"Then when it moves on after that, and points to the minute figure 5, what do we know?" "We know that it is **five minutes after the hour.**"

"Yes, and we call it **five minutes past the hour.** If it pointed to the figure 10, it would show ten minutes past; if to the figure 20, it would mean twenty minutes past, and so on."

The hour-hand might now be fixed to the clock-face and set to mark some hour—say eight o'clock. Set the minute-hand, to begin with, in its proper position on the XII, and then follow up the teaching with a few brisk exercises, to show that in certain positions, it marks a certain number of minutes past eight. This should be repeated for different hours, till the children can point out the positions readily.

While this is going on the opportunity should be taken of showing that, as the figure 15 *stands at just* **a quarter of the way round the clock-face,** *we may say either* **fifteen minutes past** *or* **a quarter past,** *as we please.*

The other side of the clock-face after passing the figure 30 *will give rather more trouble, because of the common practice of reckoning the time it points out, as so many minutes* **to the next hour.** *The teacher should first see that the positions for* 35, 40, 45, 50, *and* 55 *minutes past the hour are clearly understood, and then the matter will resolve itself into a few exercises in mental arithmetic in subtracting these numbers from* 60. *After this it will be easy to show that* **35 minutes past one hour** *is just the same as* **25 minutes to the next hour,** *and so on.*

The quarter to the hour should be dealt with in the same way as the quarter past the hour.

The teacher should follow up the lessons themselves with a few minutes' practice every day on the card-board clock-face, and she should never let slip an opportunity of calling upon some child to tell the time by the schoolroom clock.

STAGE IV

STAGE IV

LESSONS ON FORM

Lesson I

THE RHOMBUS AND RHOMBOID

Show "a square" from the "Box of Forms"; or a paper or card-board square, cut for the occasion. Lead the children to tell all they can about its shape, in some such way as this:—

"What is the shape of this figure, children?" "It is **square.**"

"How many sides has it?" "**Four sides.**"

"What can you tell me about the sides?" "They are **all the same length.**"

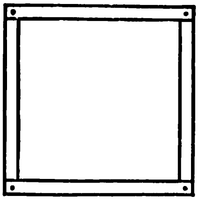
"How many angles has the square?" "**Four angles.**"

"What kind of angles are they?" "They are **all right angles.**"

"I have here some narrow strips of card-board, all the same length.

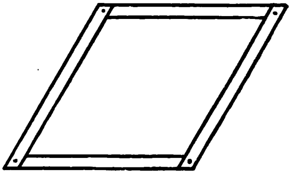
"Fred and Mary shall come to the front, and help me make some square frames with them. You must all look carefully, and notice what we do."

While the rest of the class look on, give each child four of the strips, and proceed to instruct them to make square frames by joining the ends of their strips together with little pins. See *that they pin the strips carefully, so that good squares may be made, and then let them hold their frames up for the class to see.*



Lead the children to tell that the two frames are the same shape and size. **They are both squares.** *Their* **four sides are all the same length.** *Lay them one on the other to prove this.*

Let the two children now pick up their frames again, and hold them so that the rest of the class may see. While they are holding them up, contrive in some way to put one of them "out of shape," and call attention to it as follows:—



"Look at Mary's frame now. Is it like the one Fred has in his hand?" "No; it is **not the same shape** as the one Fred has."

"What shape is Fred's frame?" "**Square.**"

"Quite right; and Mary's frame was square too at first. But it is **not square** now. Let us see what it all means.

"We will pin Fred's square frame up to the blackboard, and try to find out what is the matter with the other one."

Take the frame, and proceed with the help of the children to examine its shape. Like the square, **it has four sides.** *We know that the four sides are all* **the same length,** *because the strips of card-board were all the same length. What is it that makes it different from the square?*

Restore it to its rectangular shape. Let the children tell that it is a square once more. Why? Its angles are all **square angles.**

Now slowly alter the shape again, and proceed as follows:—

"Can you tell me now what makes the difference between this and the square frame?" "The angles of this one **are not right angles.**"

"Are they larger or smaller than right angles?" "**Two of them** are **larger than right angles, two** are **smaller.**"

"Come and point out the two that are larger than right angles.

"Quite right. What do we call them?" "**Obtuse angles.**"

"What do we call the other two that are smaller than right angles?" "**Acute angles.**"

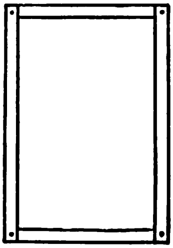
"So then this frame has **four sides all the same length,** but **two** of its angles are **obtuse angles** and **two** are **acute angles.**"

Pin it up on the black-board now, side by side with the square frame; trace the outline of both in chalk on the board; and remove them altogether.

"Here is the new figure. I want you to try and remember its name. We call it a **rhombus.**

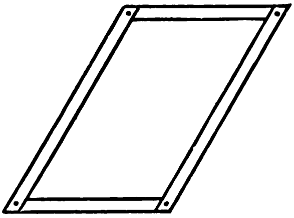
"Remember that we made it **by pushing the square frame out of shape;** and then you will also remember that its **four sides are equal,** but **none of its angles are right angles.**

"I want you next to think of the figure that is most like the square. What do I mean?" "The **oblong.**"



"How many sides has an oblong?" "**Four sides.**"

"What can you tell me about the sides?" "**Two of them are long** and **two** are **short.**"



"How many angles has it?" "**Four angles.**"

"What kind of angles?" "**Right angles.**"

Proceed in exactly the same way as before to make oblong frames with card-board strips, and show that when the angles are changed, we get a new figure, just as we did with the square.

Tell that the new figure is called a **rhomboid.**

It is made **by pushing the oblong "out of shape";** *just as the rhombus was made by pushing the square out of shape.*

"The rhombus and the rhomboid **never have square angles.**"

The children may now be exercised in drawing on their slates, naming, and picking out from the "Box of Forms," these four figures (the square and rhombus, oblong and rhomboid), till they are quite familiar with them, and their relation to each other.

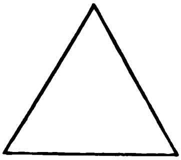
Lesson II

FIGURES WITH MANY SIDES

I. Introduction

Commence with a brief recapitulation as follows:—

"Look at this figure, children. How many sides has it?" "**Three sides.**"



"How many angles has it?" "**Three angles.**"

"What is its name?" "A **triangle.**"

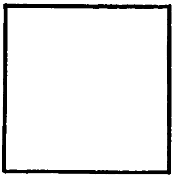
"Here is another. How many sides has this one?" "**Four sides.**"

"What do you know about the four sides?" "They are **all the same length.**"

"How many angles has it?" "**Four angles.**"

"What kind of angles are they?" "**Right angles.**"

"What is the name of this figure?" "A **square.**"

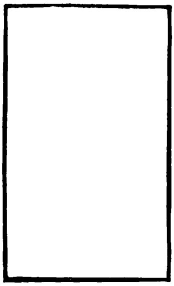


"Look at this one. It has **four sides,** and if we measure them we shall find they are **all the same length,** too. Is this the same shape as the square?" "No."

"Why not?" "Its **angles are not right angles.**"

"What do we call this figure?" "A **rhombus.**"

"Here is another, which has **four sides** and **four angles.** Look at its angles and tell me what kind of angles they are." "**Right angles.**"



"Is this figure a square then?" "No; it is not a square."

"How does it differ from a square?" "Its **sides are not all the same length.** It has **two long sides** and **two short ones.**"

"What do we call it?" "An **oblong.**"

"Now I have one more four-sided figure to show you. Look at it, and you will see that, like the oblong, it has **two long sides** and **two short ones.** Is this an oblong too?" "No; it is not an oblong."

"Why not?" "Because **its angles are not right angles.**"

"What is the name of this figure?" "A **rhomboid.**"

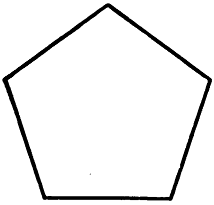
II. The Pentagon

Show the "pentagon" from the "Box of Forms." Call upon the children to count its sides and angles.

"How many sides has this figure?" "**Five sides.**"

"How many angles has it?" "**Five angles.**"

"Yes; we have already had figures with three sides and four sides. Here we have a figure with five sides, and of course five corners or angles. You must try and remember its name.



"We call it a **pentagon.** It means **five angles. Pente** means **five,** and **gon** means **an angle.**

"What can you tell me about the sides?" "They are **all the same length.**"

"What kind of angles are they?" "**Obtuse angles.**"

"Why do we call them obtuse angles?" "Because they are **larger than a right angle.**"

"Let us see what else we can find out about these five angles."

Trace the shape of the pentagon, with a pencil, on a piece of paper, and cut out the figure. We have now a paper pentagon, the same shape and size as the other.

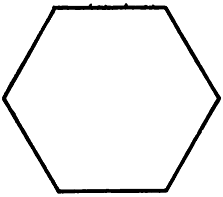
Cut off any one of the angles of this paper pentagon, and let the children see that it fits exactly into each of the five corners of the figure.

"What does this tell us?" "It tells us that **the five angles** of the pentagon are **all the same size.**"

III. THE HEXAGON

Show the "hexagon" from the "Box of Forms," and proceed in a similar way.

"Here is another figure. Look at it and tell me how many sides it has." "It has **six sides.**"



"How many angles has it?" "**Six angles.**"

"Come and measure the six sides, Fred. What can you tell me about them?" "They are **all the same length.**"

"Quite right; and if we cut the shape of one of the angles in paper, as we did just now, we shall find that it will fit all of them. What does that tell us?" "It tells us that **the six angles are all the same size.**"

"Now let us think about the name of this figure which has **six sides** and **six angles.** We call it a **hexagon.**

"I think you know what one part of the name means?" "**Gon** means **an angle.**"

"Quite right. Now I will tell you the meaning of the other part of the word. **Hex** means **six.**

"The name **hexagon** means **six angles.**"

The heptagon and octagon may be treated in precisely the same way: after which the children may be exercised in selecting, naming, and drawing the various forms, till they are quite familiar with them.

N.B.—*The regular polygons will be quite sufficient at this stage.*

Lesson III

PRISMS

I. INTRODUCTION

BEFORE proceeding to deal with these **solid forms,** *it would be well to lead the children to think about the* **plane figures** *which have been dealt with in the previous lessons.*

Have the various "forms" from the "Box of Forms" spread out on the table, or failing them, the same things cut in cardboard or paper. The children ought to be quite familiar with them by this time.

Commence by rapidly exercising the class in selecting the "forms" one by one, as they are asked for; and in telling their names when they are held up before them.

Remind them that all these are **flat "forms."** *They show* **the shape of the surface** *of things—nothing else.*

"Here is a 'form' which you have all seen before. What is it called?" "**A cube.**"

"How many sides, or faces, has the cube?" "**Six faces.**"

"What is the shape of each face?" "**Square.**"

"Suppose I want to measure the cube. What would this edge of it tell me?" "The **length** of the cube."

"And this edge?" "The **breadth.**"

"And this one?" "The **thickness.**"

"Look, I have drawn a square on the black-board. Come and point out the line which shows me the length of the square, Harry.

"Right; now the one which shows the breadth of it.

"How can I find out the thickness of the square?" "**The square has no thickness**; it is only **a flat surface.**"

"Quite true; and I want you to remember that all the 'forms' we are going to talk about now **will be like the cube. They all have thickness,** as well as length and breadth.

"We call them **solid forms.**"

II. The Square Prism

Place the cube on the table, so that all the children may see, and then stand the square prism on it. Point out that this new "solid form" fits the top of the cube exactly.

"What is the shape of the top of the cube?" "**Square.**"

"Quite right; and the bottom of the new block fits it. What must be the shape of that?" "It must be **square,** too, like the cube."

"And what can you tell me about the size of it?" "It must be **just the same size as the top of the cube,** because it fits the cube."

Let the children take it in their hands, examine it, and see for themselves that it is so.

Lead them to tell that opposite the bottom is the top, and let them examine that face of the block.

"What have you to say about the top of the block?" "It is **a square**; and **just the same size as the bottom.**"

"But the top and bottom of the **cube** are squares. Is this new block a cube too? Let us see."

Place the prism side by side with the cube. Lead the children to find out the difference between the two. The four upright sides of the prism **are not squares** *like the sides of the cube.* **They are oblongs.**

"So then we have found out that our new block is not quite like the cube. It has **six faces,** but they are **not**

all squares. Two of the faces (**top and bottom**) are **squares**; the other **four** are **oblongs.**

"We have found out that the two square ends are the same size. Now let us look at the four oblong faces."

Trace the shape of one of the faces on paper, and cut it out. Then place the paper against each face in succession.

"What has this told us?" "The **four oblong faces** are all **the same size,** for the paper fits all of them."

"Quite right. Now let us learn the name of this new 'solid form,' for you see it is not a cube. We call it a **prism**; and because the ends of it are square we call it a **square prism.**"

III. The Triangular Prism

"I have here another block. Let us examine it. It has **two ends** and **three sides—five sides in all.**

"I will stand it on one of its ends, so that you may see the three upright faces. What is the shape of all three faces?" "**Oblong.**"

"Quite right. This is a **prism** too. **It has oblong faces.**

"Now let us look at the top and bottom."

Place the end of the prism against the black-board, and trace a chalk line round it. Reverse it, and show that the other end fits exactly into the chalk line.

"What does this tell us?" "It tells us that the top and bottom ends are **the same size and shape.**"

"Look at the figure on the board. What do we call it?" "A **triangle.**"

"Quite right. The **top** and **bottom** of this prism are **triangles.** We call it a **triangular prism.**"

The hexagonal prism should be dealt with next. Proceed in precisely the same way. First examine the upright oblong faces, and then the hexagonal ends.

Lesson IV

THE PYRAMID AND CONE

I. INTRODUCTION

COMMENCE by showing the square prism. Ask for its name, and lead the children to talk about it. It has six faces—two of them squares and four oblongs. When it rests on one of its ends the four sides are all upright.

II. THE PYRAMID

1. **The Square Pyramid.**

"I have here another 'solid form.' We are going to see what we can find out about this one."

Show the base of the pyramid. Let the children tell that it is square, just like the ends of the prism. The prism rests on one of its square ends, and this figure too rests on its square end. This is why we call it **the base. Base** *means* **bottom.** *Place it on the table, side by side with the prism, and proceed thus:—*

"How many sides has this figure?" "**Four sides.**"

"Are they oblongs, like the sides of the prism?" "No, **they are triangles.**"

"The sides of the prism are upright. What have you to say about the sides of this figure?" "They are **oblique** or **slanting.**"

"Quite right. The **tops of all four triangles meet in a point.**"

Trace the shape of one of the sides on paper, as we have done before, cut it out, and fit it to all of them, to show that **all four triangles are the same size.**

"This, you see, is quite a new figure. **The sides are triangles**—not oblongs; and all **the triangles meet in a point** at the top. We call it a **pyramid.**

"This one stands on a **square base.** Perhaps you can tell me what kind of pyramid we call it?" "A **square pyramid.**"

2. **The Triangular Pyramid.**

Stand the triangular pyramid on the table next, and call attention to it as follows:—

"I have another figure now to show you. We will begin by looking at the sides of this one—not the base.

"How many sides has this figure?" "**Three sides.**"

"What is the shape of the sides?" "They are all **triangles.**"

Trace the shape of one of the sides on paper, and show in the usual way that all three are alike in shape and size. Lead the children to tell, too, that all three triangles **meet in a point at the top.**

"What must we call this figure?" "A **pyramid.**"

"Why?" "**Its sides** are all **triangles**; they all **meet in a point** at the top."

"Now let us look at the bottom of the figure that rests on the table. What other name did I give the bottom?" "The **base.**"

"Why?" "It is that part on which the figure stands."

Hold up the base of the pyramid towards the children, so that they may see its shape.

"What is the shape of the base?" "**Triangular.**"

"What kind of pyramid shall we call this one then?" "**A triangular pyramid.**"

The hexagonal pyramid may (at the teacher's discretion) be taken next. It should be dealt with in the same way. In this case again, it would be well to examine the sides first, and then proceed to deal with the base.

III. THE CONE

Lastly, show the cone as it rests on the table.

"Here we have another new figure. It is something like the pyramid in one thing. Who can tell what I mean?" "**It comes to a point,** like the pyramid does, **at the top.**"

Hold the figure up so that the children may see the base. Lead them to tell that it is **circular.**

"Yes; this is a **pyramid with a circular base.** Its proper name is a **cone.**"

In conclusion, lead the children, by way of recapitulation, to tell that the sides of the pyramid and the cone are always slanting. The base of the pyramid may be square, triangular, or hexagonal; but its sides are always triangles. **The base of the cone is always a circle.**

LESSONS ON COLOUR—SHADES AND TINTS

Lesson V

THE PRIMARY COLOURS

"We are going to have another chat about colours this morning, children.

"Which do you think are the most important colours of all?" "Red, yellow, and blue."

"Why?" "Because if we have a red, a yellow, and a blue, we can make all the others from them."

"What name do we give to red, yellow, and blue?" "We call them **the primary colours.**"

"What do we call the others which are made from them?" "We call them **the secondary colours.**"

Pin up the sheet which was used in Stage III., Lesson VI., to show the dark and light colours. Point out that on this sheet we have three reds, three yellows, and three blues. We are going to follow up what we have already learned about these. Let us commence with the top row—the reds.

"Come and point out the bright red colour on this paper, Harry. What is the difference between this one and those on either side of it?" "One is **darker** than this; the other is **lighter.**"

"Show me first the dark-red, then the light-red.

"Quite right. You may now learn the names of these two reds. We call the dark-red **crimson**; the light-red **scarlet.**

"I am going to show you how to make them. They are both made from the simple or primary red, so we will begin by pinning up this paper with a red circle painted in the middle."

Put some of the standard red into a small saucer; add a little blue to it; mix the two well together; and paint up a circle on the left of the red one. Call upon the children to observe that this is exactly the same colour as the dark-red circle on the other sheet.

"What do we call this colour?" "**Crimson.**"

"How did I make it?" "**By mixing a little blue with the red.**"

"Now let us look at the other red, which we called **scarlet.** Is that darker or lighter than the middle circle?" "It is **lighter.**"

"Do you think I could make this colour by adding blue to the red, as I made the crimson?" "No."

"Why not?" "Because blue is a darker colour than red. **It made the other red darker** when it was mixed with it."

"Right. If I want to make our red lighter, I must mix a lighter colour with it. Let us try some yellow."

Put some more of the standard red into another saucer, and add to it a very small proportion of yellow. Mix the two colours well together as before, and paint up a circle on the right of the red one. Let the children tell that this is exactly like the light-red circle on the other sheet.

Tell them its name—**scarlet,** *and remind them that it was made* **by mixing a little yellow with the red.**

"Now I want you to think. I made the **crimson colour** just now by putting **a little blue** with the red. Suppose, however, I had put as much blue as red. Would they have made crimson?" "No; they would have made purple."

"Quite right. Then, too, think of the scarlet colour. I made that by putting **a very little yellow** with the red. But suppose I had put as much yellow as red in the mixture, what colour should we have got then?" "Orange."

This should be followed up by starting again with the bright red, and adding slightly increased proportions of blue on the one hand, and yellow on the other. The resulting colours should be painted up side by side with the other circles.

"Each colour on the left, you see, is **just a shade darker** than the next. We usually speak of these as **the varying shades of red.**

"The colours on the right **become lighter**—not darker. These we call **different tints of red.**"

It is not at all necessary to trouble the children now with the names of all these **shades** *and* **tints.** *The purpose of the lesson is merely to show that the original colour may be changed into* **varying shades** *and* **tints**—*the former, by mixing with it a* **colour darker than itself,** *the latter by the addition of* **some lighter colour.**

"Look at these two pretty ribbons. This is **pink**; this one **rose-colour.** They are two **tints formed from red.** I will show you how they are made.

"To make the **pink** I have only to mix **some white with a little crimson.** But if I mix the **white with bright red** I get this other tint, **rose-colour.**"

Show, too, that each of these tints can be made **paler,** *or* **warmer,** *by varying the quantities of the two colours that are mixed.*

Deal in precisely the same way with the yellows and the blues. Starting with the rich pure primary yellow, show how it may be changed into varying tints, **by mixing with it varying quantities of white,** *and into varying shades* **by the addition of more or less red.** *The darkest shade of all is the secondary colour*—**orange.**

In dealing with the blues, take ultramarine as the original, and show how the varying tints are formed from it by the addition of more or less white, till **the light azure blue of the sky** *is reached.*

The shades of blue are produced by mixing varying proportions of red with the original blue.

One very beautiful blue, known as Prussian blue, is formed by adding a very slight quantity of green to the primary blue.

Before closing the lesson, the children should be briskly exercised in selecting and matching these tints and shades of the three primary colours, with the help of the box of colours, ribbons, coloured wools, and paper strips, till they are quite familiar with them.

Lesson VI

SHADES AND TINTS—SECONDARY COLOURS

LEAD the children to recapitulate briefly the teaching of the last lesson in some such way as this:—

"What name do we give to the three principal colours—red, yellow, and blue?" "We call them the **primary colours.**"

"Come and pick me out the primary red, yellow, and blue colours on the table, Mary.

"Those are right. Now look at this one which I have in my hand, what colour is it?" "It is blue."

"So is the one you have. Is this one the primary blue, too?" "No; it is **a light tint** of blue."

"How is this light tint of blue got from the primary colour?" "It is got **by mixing some white** with the blue."

"Show me your primary red. Here is another red. Is it the same as yours?" "No, it is **darker.** We say it is **a darker shade of red.**"

"Do you know what it is called?" "It is called **crimson.**"

"How was it made?" "By mixing **blue,** which is a dark colour, **with the primary red.**"

The recapitulation can be extended in this way, and by exercising the children in selecting and matching colours, as far as the time will allow; after which the teacher may proceed as follows:—

"What name do we give to the three colours—green, orange, and purple—which are made from the three primary colours?" "We call them the **secondary colours.**"

"Let us take green first. Can you tell me how to make green from the primary colours?" "Mix yellow and blue together."

Make a good grass-green by mixing blue with **rather more than half the quantity** *of a rich bright yellow.*

Let the children see what is being done. Paint up a circle on the paper as usual. Tell the children that this is called a **grass-green** *because it is the colour of grass. Call upon one or two of them to come to the front, and select a green just like this one, from the colours on the table.*

Now take some other greens and pin them up side by side with the green circle. It would be well to place the darker shades on the left, and the lighter tints on the right of the circle as before.

"Now look at these colours, children. Like the circle in the middle they are all green, but you see they are not all alike.

"Let us take this one first (*pointing to the light pea-green*). What can you tell me about it?" "It is a **lighter green** than the green of the circle."

"How do you think it was made? I will try and show you.

"You saw that to make our grass-green I put rather more than half as much yellow as blue. Watch what happens when I add more yellow, little by little."

Mix well each time, and paint up a circle side by side with the others on the paper. Lead the children to tell that each new circle is a **lighter green** *than the one before it. These* *are all* **lighter tints of green.** *They were all made by adding more and more yellow colour.*

Show that by taking a light tint of blue and a light yellow we can make **a very pale tint of green,** *different from any of these.*

Now show that, if in mixing the blue and yellow we increase the quantity of the former, the green which we get is not the colour of the grass, **but a darker shade.**

Mix and paint up, as before, some of these darker shades of green.

"Here is a very dark green. We call it **olive-green**; and here is another quite as dark with a yellowish tinge in it. This one is known as **bottle-green.**"

Turning next to the **orange colour,** *let the children tell how it is formed. A bright orange—the colour of the ripe fruit—is made by mixing yellow* **with rather more than half its quantity of red.**

Mix and paint up the colour as usual. Show that the shades and tints of this colour may be changed again and again, according as more red or more yellow is added.

Lastly, deal in the same way with purple. **Equal quantities** *of* **red and blue** *make a good purple. Lead the children to tell from their last lesson that if more red than blue is added, the colours formed will be lighter and lighter tints of purple. As more and more red is added, the colour will change from* **a purple tint** *to a* **dark shade of crimson.**

Two pretty colours—lavender and lilac—are really **light tints of purple.** *They are both made by mixing some white with the purple.*

Lesson VII

SHADES AND TINTS—BROWNS AND GREYS

"We are going to learn how to mix some more colours this morning, children.

"Do you remember what colours we talked about in our last lesson?" "Green, orange, and purple."

"We have one name for all these. What is it?" "**The secondary colours.**"

"Can you tell me why we give them this name?" "Because they are made **by mixing the primary colours** together."

"How many colours do we mix to make green?" "Two."

"How many to make orange?" "Two."

"And how many to make purple?" "Two."

"We once made some new colours by mixing—not two—but three other colours together. Do you remember what they were?" "Brown and grey."

"Can you tell me how to make brown colour?" "Mix red, yellow, and blue colours together."

"And how do we make grey?" "By mixing black and white and adding a little of some other colour."

"Let us begin now by making a brown. What colours shall I want?" "Red, yellow, and blue."

"Yes, we can make a brown, as we did once before, with these three colours; or we can make it with red, yellow, and black. That is, we can use **black** instead of **blue** if we wish."

Mix two browns, using black in one and blue in the other. If the mixing is carefully done, there should be a distinct **tinge of purple** *in the latter—slightly approaching the colour of claret. This, of course, is entirely wanting in the other brown.*

It would be well for the teacher to accustom herself beforehand to mix colours such as these, in order that she may know exactly, from experience, the quantity of each constituent required for a certain shade or tint.

The aim should be to get a good medium brown to start with, and this should be painted up on the sheet of paper as usual. Ribbons, skeins of silk, and coloured paper-strips of varying shades of brown should now be shown, and the children should be led to compare them with the brown colour on the paper.

"All these are brown; but are they all like the colour which we just painted on the paper?" "No; some of them are **darker,** some are **lighter** than that."

"What do we say about them?" "We call them different **shades and tints of brown.**"

"Let us try and make some of these shades and tints of brown now."

This may be made very interesting. The children should be allowed to assist in the preparation and painting of the new colours, and they will readily see how the changes are brought about. If a warm tint is wanted, **red must be added,** *the quantity varying according to the depth of the tint.* **Chocolate** *is a full, rich reddish-brown. Mix this colour; have it painted up; tell its name; and show some chocolate-coloured ribbons.*

Add a little ivory black to the mixture, and a dark shade of brown will be the result. The shades may be varied by increasing the quantity of black.

Chestnut brown, *so called because it is the colour of a chestnut, is a very rich dark shade, but it has* **a decided yellow tinge.**

The lighter tints of brown may all be formed from the medium colour **by adding yellow.** *If a full, deep yellow is used, the result will be* **a snuff-coloured brown.** *Lighter yellows will produce the paler brown tints.*

Proceed now to deal in a similar way with the shades and tints of grey.

Make first a good medium grey, by mixing some black with about three times its quantity of white, and adding a very little blue. These, if well mixed, will give a grey **the colour of steel;** *and by slightly increasing the quantity of blue from time to time, a number of* **bluish-grey tints** *will be produced, till* **slate-colour** *is reached.*

If to the medium grey colour some more white and a very little yellow are added, a **light yellowish-grey tint,** *the colour of* **polished tin,** *will be the result. But if the same little quantity of blue were used instead of yellow, it would give* **a pearly grey,** *the colour of* **silver.**

A stone-grey *may be formed* **by adding red** *to the* *medium colour. The same quantity of* **blue** *produces* **slate-colour,** *which is a dark-bluish grey.*

SOME USEFUL PLANTS

Lesson VIII

CORN

"OUR earlier lessons have taught us what a plant is, and how it lives and grows in the ground. We are now going to try and learn something about the uses of plants. You will soon find that plants, besides being beautiful to look at, are very useful to us. We could not do without them. We will begin to-day with some of the plants which give us food."

Show a piece of bread. Lead the children to think about this one article of food. Let them try and picture what would happen if there were no bread to be got for a week. We could not put anything else in its place. We eat bread at every meal. We could not live without bread of some kind.

"Do you know what this bread is made of, children?" "It is made of **flour.**"

"Quite right. I have some flour here. You have seen mother use flour at home. What does she do with it?" "She makes **cakes, puddings,** and **pies** with flour."

"What is the man called who makes the bread?" "The **baker.**"

"Where do you think this flour comes from?" "It is **made from wheat.**"

"Quite right. Here are some grains of wheat. The miller grinds the grains of wheat into a white powder in his mill. **The powder is flour.**

"But where did the grains themselves come from?" "They **grew on plants** in a corn-field."

"Let us have a chat about these **corn-plants** now. I have some young corn-plants growing here in this flower-pot. What do they look like?" "They look like **grass.**"

"See, I will pull one up. Here is the grain of wheat from which the little plant grew. You can see the **green blades** (like blades of grass) growing up, and the little roots, which spread down into the soil.

"If you could see a corn-field, with the young corn-plants coming up, it would look **just like a field of grass**; and I want you to remember not only that these corn-plants look like grass, but that **they really are a kind of grass.**

"This corn-grass grows very tall—taller than most of the boys and girls in the class."

Show some long straws. Call upon the children to tell what they are, and mention some of the uses we make of straw.

"Do you know what this straw really is? I will tell you. It is **the long stem of one of the corn-plants.** Our little corn-plants in the flower-pot are green, like all other grass, and so are the plants in the corn-field at first. But when they get ripe **they turn yellow,** just like this straw."

Let the children proceed next to examine the straw for themselves. Point out, in the first place, that **the straw is hollow**; *then show the* **knots** *or* **joints** *in it here and there.*

Tell that the stems of all kinds of grass are like this. **The leaves** *always* **spring from these knots or joints** *in the stem. Grass of all kinds has* **long, narrow, pointed leaves.** *When this straw was the living, green stem of a corn-plant, there were leaves growing from all these joints.*

Show a bunch of flowering grass. Tell that the corn-grass has **small green flowers,** *too, and when these flowers die off* **they leave the seeds** *behind.*

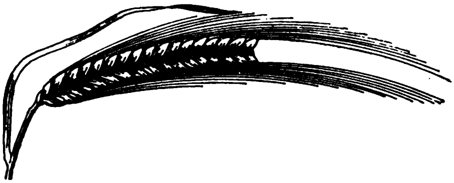
"Do you know what this is?" "It is an **ear of corn.**"

"Quite right. Let us pull the ear to pieces and see what we can find."

Show that the ear contains **a great many grains** *of corn; and that each grain is held in a sort of shell, which we call* **the husk.**

"This ear is the part that comes when the flowers die off. The **grains of corn** in it are the seeds.

"This one is an **ear of wheat,** and the grains are **grains of wheat.** Wheat is the best of all corn. Our bread is made from the **flour of wheat.**"



Show some other ears—of **barley** *and* **oats.** *Tell their names, and point out how they differ from the ear of wheat. Barley flour or barley meal does not make nice sweet bread. People never use it for bread when they can get wheat. We use* **barley** *for* **feeding pigs and poultry.** *The flour made from oats is called* **oatmeal.** *In some cold countries, where wheat will not grow, the people live on* **oatmeal cakes** *and* **porridge.** *We use* **oats for feeding horses.**

A picture of the **harvest field** *should be shown and described. It would add to the intelligent interest of the children, and give them something to think about.*

Tell that in some countries it is too hot for wheat to grow.

People then grow other kinds of corn. But **they are all grasses.**

Show **the cobb of maize,** *and a few single* **grains of the corn.**

Tell that this is sometimes called **Indian corn**; *people in many parts of the world make their flour from it.*

Show some **grains of rice.** *Let the children say what they are.*

Tell that in the **very hot parts** *of the world* **rice is the bread of the people,** *just as wheat is ours. They could not live without it.*

Lesson IX

VEGETABLES

Commence by showing one or two boiled potatoes on a plate.

"You, of course, know what these are, children?" "They are **potatoes.**"

"Where did you last see potatoes like these?" "On the table at dinner time."

"Do you know what this is?" "That is a potato, too."

"But this one is not like those in the plate. Can you tell me why?" "Those in the plate have been boiled; this one is raw."

"Where does mother get the potatoes from?" "She gets them from the greengrocer."

"What do we call the things she buys from the greengrocer?" "**Vegetables.**"

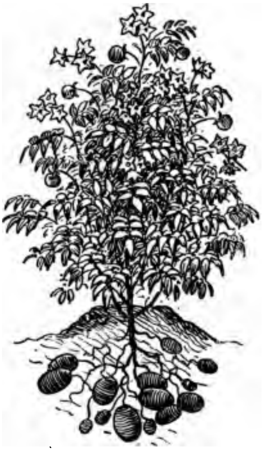
"Tell me the names of some of the vegetables besides potatoes you can see in the greengrocer's shop." "Cabbages, peas, beans, carrots, turnips, parsnips, onions."

"What must mother do to all these vegetables to make them ready for dinner?" "She must cook them."

"Can you tell me where all of them come from?" "They all come from plants which grow in the ground."

"Let us take them one by one and see what we can learn about them. We will begin with the potato. You told me the potato came from a plant, and you were quite right. But do you know from what part of the plant it comes? I will show you."

Set up in front of the class a good picture of the growing potato-plant, with a section of the soil showing the roots and tubers. Let this latter part be covered up at first with a sheet of paper.



Call attention to the rest of the plant, which can be seen above the ground. Point out the green stems, the green leaves, the pretty flowers, and the small, round, green balls that come after the flowers fall. Tell that these little balls are full of seeds. If possible show one of them. Lead the children to tell that it is the fruit of the plant, and why.

"But we have not seen the potatoes themselves yet. Let us see if we can find them."

Remove the sheet of paper, which, till now, has been hiding the parts below the surface of the soil. Let the children point out the potatoes.

They will, of course, say that these are the roots of the plant. Point out the actual roots. Show that they are like the roots of other plants which we have examined.

Tell that the potatoes themselves **are not the roots**; *they are* **parts of the stem** *which stretch under the ground. We call them* **tubers.** *Show the* **eyes** *in an actual potato. Tell that* **these eyes** *are* **buds.** *If the season of the year permit, it would be well to show a potato "growing out" at the eyes.*

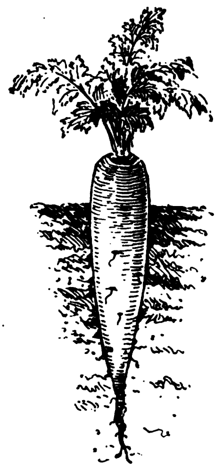
The real roots of plants never have buds like these.

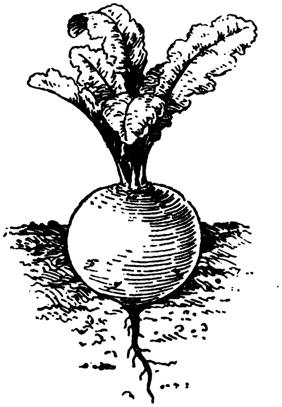
Tell that when the potato-plant is fully grown, the green stems all die down to the ground, and then is the time to get the potatoes and store them up for use. How do the men get the potatoes?

"Here are some other vegetables which you know something about already. What is this?" "A carrot."

"And this one?" "A turnip." "And this?" "A parsnip."

Show pictures of the growing plants, with section of the soil in which they stand, as before. Lead the children to tell that these are **the actual roots** *of the plants. We have already spoken of them in our earlier lessons as* **fleshy roots.**





"What kind of plants have fleshy roots like these?" "**Plants that live through the winter** into the next season, and then bear flowers and seeds."

"Here is another very useful vegetable. What is it?" "An onion."

Show a picture of the growing plant, as before. Point out the long stringy roots stretching down into the ground. Show that the onion itself is not the root. It is **the lower part of the stem** *swollen out into a round ball. We call it* **a bulb.**

Take the cabbage next. Lead the children to tell what it really is.

Show a picture of the growing plant.

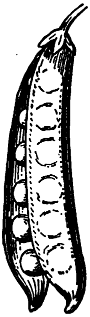
Refer to the lesson on leaves and buds. Cut the cabbage in two and show the children that it is made of **leaves folded one over the other.** *It is a great* **bud.** *Notice the whiteness of the inside of the ball. Tell that the leaves are white* **because the light cannot get to them** *in the middle of the ball. All leaves become white if they are shut away from the light.*

If time permit, a head of celery should be shown. This vegetable is made white by having the earth heaped up round it, so that no light can get to it. Point out that it is **the leaf-stalk of the celery plant,** *and not the leaves themselves, that we eat.*

Show next some pods of peas and beans. If the time of year permit, the green pods should be provided. Let the children tell all they can about them.

Show pictures of the growing plants, as before. In these plants we do not use either the root, the stem, the leaf-stalk, or the leaf. It is the **seed pod and its seeds** *which give us food.*

Lead the children to tell that in the French bean variety we cut up the green pods and cook them just as they are; but we simply open the pods of peas and broad beans, and cook the seeds alone.



"So you see we do not use the same parts of every plant for food. One plant gives us its **root**; another its **under-ground stem**; in another **the stem is swollen out into a ball** to make the part which we want for food; another gives us its **leaves**; another its **leaf-stalks**; and another its **seed-pods**."

Lesson X

PLANTS WHICH GIVE SUGAR

Commence by leading the children to think over the subject of the last lesson. Let the vegetables on the dinner-table suggest a chat about dinner itself. Mother often gives the children a treat at dinner in the summer-time, in the shape of delicious fruit-pies or puddings, or some nice ripe fruit. Let the children themselves name all the different kinds of fruit they can think of, such as cherries, currants, strawberries, gooseberries, apples, plums, pears, and so on.

"Fruit is good for us to eat. Let us see what we can learn about it.

"In the first place where does all fruit come from?" "**It grows on a plant** of some kind."

"Some of the fruits you named just now grow on trees. Can you tell me which they are?" "**Apples, pears, plums,** and **cherries** grow on trees."

"Quite right; but **gooseberries** and **currants** grow on small bushes; and **strawberries** grow on little plants low down on the ground.

"Can you tell me what it is that makes fruit nice to eat?" "It is because the fruit is **full of sweet juice.**"

"Does all fruit taste sweet?" "Fruit is not sweet till it is ripe."

Show one or two specimens of ripe fruit. Call attention to the rich sweet juice in them. Tell that the juice is sweet **because it contains sugar.**

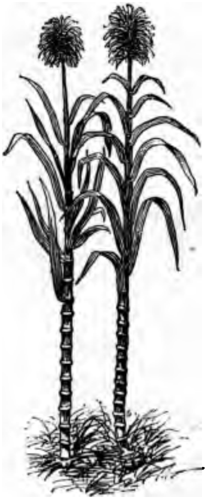
Show some sort of dried fruit, such as **raisins.** *Open one or two and point out the* **lumps of white grape-sugar** *inside. Tell that these little lumps of sugar were formed*

from the dried juice *of the fruit. Let the children taste it that they may be sure it is sugar.*

"So then we could get sugar from our ripe fruits, if we wished. We want a great deal of sugar; but it would not do to destroy all our delicious fruit to make it. I am going to tell you how we get all the sugar we use."

THE SUGAR-CANE

Show a picture of the sugar-cane. Tell that nearly all the sugar we use is made from this plant. We call it **the sugar-cane.**



"Before we begin to examine this picture of the sugar-cane, I want you to think for a moment about the corn-plant.

"What kind of plant is it?" "It is **a sort of grass.**"

"What can you tell me about the leaves of every kind of grass?" "They are **long, narrow,** and **pointed.**"

"On what part of these grass-plants do the leaves always grow?" "They spring from **knots or joints in the stem.**"

"Where do we look for the flowers in these grasses?" "They are always in a bunch **at the top of the stem.**"

"Now we may turn to our picture of the sugar-cane.

"What do you notice about the stem?" "There are **a great many knots** or **joints** in it."

"What kind of leaves has the plant?" "It has **long, narrow,** and **pointed leaves.**"

"From what part of the stem do the leaves spring?" "**From the knots or joints** in the stem."

"What do you see at the top of the stem?" "**A bunch of flowers.**"

"Now, of course, you can tell me what this sugar-cane really is?" "It is **a sort of grass.**"

"Quite right; it is. But it is a very tall, strong kind of grass. It grows **ten** or **twelve feet high;** some kinds of sugar-canes reach **twenty feet** in height."

See that the children form a correct notion of all measurements such as these, by comparing them with things around.

"These canes are not only tall; they are **stout and thick.** When fully grown they are thicker than your arms.

"You know, too, that the stems of most grasses are hollow. The **stem of this one is solid.**

"But we have not yet found out where the sugar comes from.

"Where do we find the sugar in our ripe fruits?" "The sugar is the sweet juice of the fruit."

"Where did this juice come from?" "It came **from the sap.**"

"Where do we find the sap of plants?" "The sap is in all parts of the plant."

"Quite right. **The watery food,** which the roots suck in from the soil, passes up through the stem into all parts of the plant and **becomes sap.**

"The sugar-cane, like every other plant, has sap flowing through its stem.

"When the canes are quite ripe, the sap in the stem becomes **very sweet.** It tastes like **the juice of a very ripe apple.**

"They are then cut down, and carried to a mill, where they are crushed between heavy iron rollers till all the sweet juice is squeezed out.

"The juice is put into large pans and boiled. When it has boiled long enough it is turned out of these pans, and left to cool. As it cools it forms into **solid grains of sugar,** like this in my hand."

Show some coarse, moist sugar. Tell that this is sometimes *called* **raw sugar.** *It is afterwards made white like these pieces on the table, and is then known as* **loaf-sugar,** *or* **lump-sugar.** *But both kinds come from the sweet juice of the sugar-cane.*

Lesson XI

TEA, COFFEE, AND COCOA

Commence with one or two questions dealing with the subject of the last lesson, to enable the children to tell what sugar is and how it is obtained. Pass on to notice the many uses we make of sugar. We use it every day of our lives, and perhaps several times in each day. In this way lead up to the drink which forms a necessary part of our daily meals—tea, coffee, and cocoa. We are now going to see what we can learn about each of these.

I. Tea

Make a cup of tea by pouring boiling water on some dry tea in view of the children. Call upon them to notice and tell what takes place. The water **becomes coloured** *in the cup; it is this coloured water that we drink when we ask for a cup of tea.*

"Come to the front, Mary, and take this cup of tea in your hand. If you put it to your nose you will find that it has **a pleasant smell,** which was not in the water itself.

"Now sip a little of it. What do you notice?" "It has **a nice, pleasant taste.**"

"Here is some dry tea just as it came from the grocer's shop.

"Put some of this in your mouth and tell us what you notice." "It tastes **just like the tea in the cup.**"

"Then, of course, it is this dry tea which makes the pleasant drink. Let us find out what it is."

Pour the liquid out of the cup, and place the leaves in a saucer. The children will at once tell that they are the **tea-leaves**; *this is a name quite familiar to them.*

"Let us see why we call them tea-leaves. I will pick out one or two of the largest pieces and spread them out on this sheet of blotting-paper.

"If you look carefully, you will see that these pieces are **real leaves.** You can see the shape of them, except where they are broken. You can see **the ribs of the leaves.**

"Here is a picture of these leaves as they grow on the plant, and you can also see the flowers.

"The plant on which they grow is a very pretty one, for **the leaves are**

always green, and **the flowers** are **white** with a bright yellow middle. We call it **the tea-plant.**

"I cannot show you this plant alive as I can some other plants, because it will not grow in our country.

It grows in some warm lands far away from ours. Here is a picture of a great field in which the tea-plants are growing in long rows.

"Men, women, and children pick the leaves, one by one, from the plants.

"All that they want is to be dried, roasted, and rolled up into little grains like these I have in my hand. The tea is then ready for use.

"Here, you see, is a plant **which gives us its leaves for use.** The rest of the plant is useless."

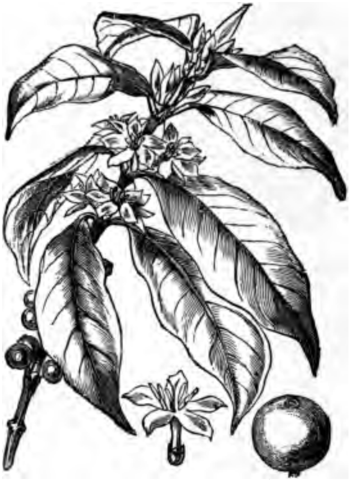
II. Coffee

Proceed in a similar way to make a cup of the beverage, and have it tested as before for smell and taste. After this show the brown powder from which it was made, and compare the two.

Produce some **coffee-berries**; *but do not attempt at* *present to say what they are. Tell that the brown powder was made* **by grinding some of these** *in a coffee-mill. If a small coffee-mill could be obtained, it would add to the interest, to grind some coffee for the children to see.*

"We are quite clear now that our cup of coffee is not made from leaves, but from **these little oval balls.** Let us see what they are."

Show a picture of the coffee-tree. Lead the children to pick out the berries. Explain that we get our coffee from these



berries. They are **the fruit of the tree**; *they come as the flowers fall off. Point out the pretty white and rose-tinted flowers themselves. Tell that the* **tree is an evergreen**; *its leaves are a bright glossy green.*

Altogether it is a very beautiful tree. It will only grow in very hot lands.

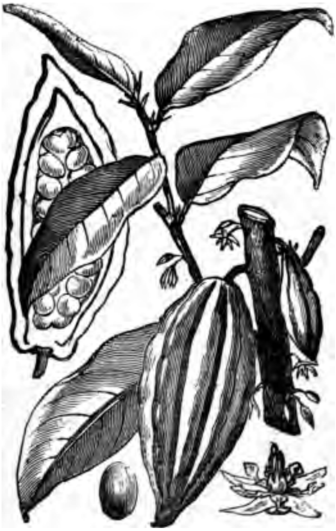
"The tea-plant does not grow higher than you, children, but the **coffee-tree grows from eight to ten feet high.**"

III. COCOA

Make the cup of cocoa, and deal with it in precisely the same way; and then proceed to show, first **the powder,** *then* **the nibs,** *then* **the beans,** *and lastly* **the pod in which the beans grow.**

From this make it clearly understood that **this cocoa has nothing whatever to do with the cocoa-nuts** *which we see in the fruiterers' shops.*

Show a picture of the tree, and another of the leaves, flowers, and fruit. This **fruit is the pod** *which the children have just been shown. The tree itself is about* **as big** *as our* **cherry-tree.** *It grows in very hot lands: it would not grow here.*



Lesson XII

PLANTS USEFUL FOR CLOTHING

I. COTTON

SELECT some article of clothing worn by one of the children, and let that suggest the lesson. Proceed in some such way as this:—

"Come here, Mary, and let me see your pretty frock. Isn't it a pretty frock, children? What sort of frock do you call it?" "A cotton frock."

"What makes a cotton frock so nice to wear in the summer?" "It can be easily washed and ironed when it gets dirty."

"Why do you call it a cotton frock?" "Because it is **made of cotton.**"

"If you look round the class you will see several girls besides Mary with cotton frocks. But what do little girls wear over their frocks?" "A pinafore."

"Do you know what your pinafores are made of? Well, they are made of cotton too. We call the stuff **cotton-print,** because when it is made, these pretty flowers and figures **are printed on it.**

"Now let us look at the boys. Do boys wear cotton clothes?"

Lead the class to pick out the **cotton blouse** *and* **knickerbockers** *of some boy. Remind them that a careful boy can keep his cotton suit neat and tidy for a long time. When it gets dirty it can be washed.*

Show next a piece of **calico.** *Let the children tell what it is. By referring to the needlework lessons, lead them to tell what kind of garments are made of calico. We use calico for making garments* **to be worn under** *our other clothes. We call these our* **underclothes.** *Let them name various articles of underclothing.*

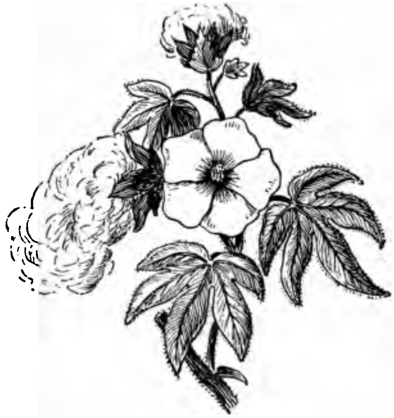
Point out again that calico is one of the very best things we *could use for this purpose. Our* **underclothes get dirty** *with wear, and we change them for clean ones, from time to time. The dirty clothes which we take off can be easily washed and ironed, and then they are ready for us to wear again.*

"I want you to remember that this **calico,** like Mary's **frock,** John's **blouse,** and your **pinafores,** is **made of cotton**; and so are your **handkerchiefs,** and the **bed clothes** and **night-dresses** in which you sleep. We all wear something made of cotton night and day.

"Now I am going to give you a surprise. What would you say if I told you that this stuff—cotton—of which so much of our clothing is made, **once grew on a plant?** Well; it is so. We are going to learn something about cotton to-day.

"Here is a picture of the plant on which it grows. We cannot see it growing here, because it will not live except in the very warm parts of the world.

"When the plant is growing, it **looks very pretty,** for its leaves are of a **rich dark-green colour,** and it bears **large, bright-yellow flowers,** with a purple centre. When the plant is fully grown it is between two and three feet high. Its flowers then die off.



"What do the flowers of all plants leave behind when they themselves die off?" "**The fruit.**"

"What do we find in the fruit?" "The **seeds.**"

"Quite right; and it is just so with the cotton plant. When this pretty yellow flower of the cotton plant dies off, it leaves **a round pod,** which grows till it is about **the size of a walnut.** It then bursts open; and what do you think it has inside it?" "Seeds."

"Yes, there are seeds of course; but besides the seeds there is **some beautiful white wool. The pods are full of this white wool**; and it is that which makes them burst open."

A cotton pod with its seeds, and soft white downy wool, should be shown if possible. Where the pod itself cannot be obtained, show a sketch of one. Show also a handful of cotton-wool.

Picture the appearance of the cotton plantation at picking time—the rows of cotton plants with their bursting pods of white cotton-wool covering them all over like patches of snow.

Tell that the pods are picked in the autumn by women and children, and after the seeds are removed, the cotton itself is packed in great bundles and sent away to be made up into all *sorts of useful things. Promise that some day they shall learn how this is done.*

II. Linen

"I want you now to look at Harry's nice white collar. Do you know what that is made of?" "It is made of **linen.**"

"Quite right. Linen is better than calico for making collars and cuffs, and the fronts of gentlemen's shirts. It looks **smooth and glossy** when it is starched and ironed. It is **very strong** too; much stronger than cotton.

"Let us see what this linen is. It comes from a plant, which we call **the flax plant.** Here is a picture of it. It is a small plant, which grows from two to three feet high."

Call attention to its **long slender stalks,** *with the* **pretty pale-blue flowers** *at the top. Tell that when these flowers die off they leave in their place* **pods** *or* **seed-vessels, full of little flat oval seeds.**

Show some of these seeds. Perhaps some of the children will be able to recognise them. If not, tell their name, and show the connection between **linseed, linseed oil,** *and* **linen.**

"But we have not yet found out where the linen itself comes from, for of course it does not come from these seeds.

"What do we call that outside skin which covers all parts of the plant?" "We call it the **bark.**"

"Quite right. But plants have **two barks**—one on the outside, which is called the **outer bark,** and one underneath it, which is known as the **inner bark.**

"Our linen **is made from the inner bark of the flax plant.**

"When the plants are fit to gather, they are pulled up by the roots, and steeped in water till all but the tough inner bark of the stem is rotted away.

"The soft rotten parts are then removed, and the rest is used to make our beautiful white linen."

N.B.—*This lesson might be very profitably followed by one on the woody stems of plants, which give us timber for building purposes, and all sorts of beautiful woods for making furniture and other things for use.*

LESSONS ON COMMON OBJECTS

Lesson XIII

INDIA-RUBBER

I. Flexible

Commence by showing a strip of india-rubber and a strip of wash-leather about the same size. Bend, twist, and squeeze both *of them, and call upon the children to notice that these things do not break or tear, however roughly we treat them. Then proceed as follows:—*

"Both these things, you see, will stand a great deal of rough usage without breaking. Take them in your own hands, Harry, and try. You cannot break or tear them. Can you tell me what we say about things that do not break easily?" "We say they are **tough.**"

"Then what shall we say about the india-rubber and the leather?" "The **india-rubber** and the **leather** are both **tough.**"

"You notice, too, that I can bend and twist them just as I please. I want you, now, to learn a hard word that means all this. We say a thing is **flexible when it bends easily. India-rubber** and **leather,** then, are both **flexible.** They bend easily.

"Take this stick of slate-pencil and bend it. You see it will not bend; it snaps in two when you try to bend it.

"What do we say about the pencil because of this?" "We say the pencil is brittle."

"Quite right. The **india-rubber** and the **leather** are **not brittle.** They are **tough, because they do not break easily**; and they are **flexible,** because **we can bend them as we wish.**"

II. ELASTIC

"I want to show you now that, although the india-rubber and the leather are alike in being tough and flexible, there is one thing in which they are not at all alike. You must watch everything I do, and try and find out what this is."

Take the piece of wash-leather, fold it up close, press the folds well, and lay it on the table. Call upon the children to name other things which can be folded up in the same way. Assist them to mention such things as their handkerchiefs, their *clothes, dusters, table-cloths, sheets, pieces of paper, and so on. Let a child fold up one or two things on the table.*

Explain that all these things, like the leather, are flexible; that is why we can bend them. But besides bending them we can fold them up. All things that **can be folded up** *like this are said to be* **pliable.**

"Now you shall take the piece of india-rubber, Mary, and fold it up, as we folded the other things. That will do. Now lay it on the table.

"What do you notice?" "**The india-rubber springs back** and unfolds itself again, it will not lie folded up like the other things."

"What did we say about them?" "They are **pliable.**"

"Quite right, and the india-rubber, of course, is **not pliable.**"

Lay the strips of india-rubber and wash-leather side by side on the table. Measure them, and show that they are exactly the same length.

"I want Fred to take the ends of the india-rubber in his two hands and pull them; and Mary shall do the same with the strip of leather.

"What do we see?" "The **india-rubber** and **the wash-leather have stretched.** They are longer than they were."

"Very well. Lay them on the table again, and we will measure them, and see how much longer they are."

Measure the two as they lie on the table, so that all the class may see. Point out that the leather actually is longer now than it was before it was pulled. The pulling has stretched it; **but the india-rubber is exactly the same length as it was at first.**

"I thought you said you had stretched it and made it longer, Fred. Try again and let us see."

Have the two things stretched again, and let the children hold them in that condition against the edge of the table. Instruct each of them to let go one end, without moving the hands from their position on the table.

"Now tell me what you noticed when Fred let go one end of the india-rubber." "**The india-rubber sprang back** when he let go. **It became short again.**"

"Quite right. But look at the wash-leather. Has that got shorter too?" "No, the leather did not spring back when Harry let go."

"You remember that when we folded the india-rubber up it would not remain so, but sprang back again as soon as it was left to itself. So then you have seen that the india-rubber, although it will stretch when we pull it, **springs back** to its proper size and shape **as soon as we let go.**

"You must learn to say that **india-rubber is elastic,** because **it springs back** in this way. But wash-leather and paper are not elastic, they do not spring back."

Lesson XIV

A SPONGE

Show a large dry sponge. Call upon the children to say what it is, and tell all they can of its uses.

Let one of the children take it in her hands and examine it for herself. If she holds the sponge in one hand and something else about the same size in the other, the first thing to strike her will be its lightness. Sponge is **very light.**

Prove how light it is by placing it in a basin of water. It is so light that it **floats on the very top of the water.** Light things always float in water; heavy things sink.

Hand one or two dry sponges round the class, and proceed thus:—

"Take the sponges in your hands and squeeze them. Could you squeeze a wooden ball like that?" "No."

"Why not?" "Because the wooden ball is hard; **the sponge is soft.**"

"Now drop your sponges on the desks, as I drop this piece of chalk.

"The chalk breaks, you see, as it falls. Are your sponges broken, too?" "No; the sponges are not broken."

"Pull them, squeeze them, strike them. Can you break the sponges?" "No."

"What can you tell me then about sponge?" "**Sponge is tough,** because it will not break."

"Quite right. The piece of chalk breaks easily. We say that it is brittle.

"Now I want you to squeeze your sponges in your hands once more, and notice carefully what happens when you open your hands again. I will squeeze this piece of paper in my hand at the same time. The paper is soft; I can squeeze it easily.

"Now let us open our hands. My paper, you see, is squeezed up into a hard ball. How do your sponges look?" "The sponges are **the same shape now as they were at first.**"

"What did your sponge do as soon as you opened your hand, Mary?" "**It swelled out** and **got big again** as soon as I left off squeezing it. **It went back to its proper shape.**"

Lead the children to think about the last lesson. Let them tell that the piece of india-rubber went back to its proper shape when we let it go after pulling it.

"What do we say about india-rubber because it does this?" "We say that india-rubber is **elastic.**"

"Now let us look again at the sponge. Watch me: I squeeze it up quite small in my two hands, and as soon as I let go it springs back to the same size and shape as it was before.

"What shall we say about the sponge then?" "**The sponge is elastic.**"

Place the dry sponge next in a saucer of water, so that all the children may see, and then call upon one of them to come out and take away the sponge. This done, turn the saucer up, and show that there is no water at all in it now.

"What has become of the water? Have you spilled it, Mary? I will tell you. **The water is in the sponge.** See, I will squeeze it all out into the saucer again.

"Look at this stone now. I will put that into the water. Does the water leave the saucer and go into the stone as it did into the sponge?" "No."

"Now take your own sponges in your hands and look well at them. See if you can tell me why the water passes up into the sponge, and not into the stone." "There are **little holes all over the sponge**; but there are no holes in the stone."

"Quite right; and the holes are not only on the outside of the sponge, but all through it."

Cut a piece of it away and show the holes.

"**The sponge is full of holes.** These little holes are called **pores,** and because the sponge is full of holes we say that it is **porous. Porous** means **full of pores** or **holes.**

"The sponge sucks up the water because it is porous. The water fills up the little holes in it.

"When we squeeze the sponge we squeeze the water out of it again."

Show that it is all these things together that make a sponge so useful for washing purposes. It is **soft** *and* **smooth,** *so that it* **does not scratch the skin,** *and yet it is* **tough,** *and will* **not easily tear.** *It is* **porous** *and* **sucks up water** *into its pores; and when we squeeze it,* **we squeeze out the water again.** *As soon as we leave off squeezing it,* **it springs back** *to its proper size and shape again, for* **it is elastic,** *and it is then ready to suck up more water.*

Lesson XV

MINERALS

Have the various objects to be dealt with in the lesson set out in readiness on the table; call attention to them one by one, and commence thus:—

"We have seen most of these things from time to time in our lessons. Suppose we try now and find out something about each of them.

"Let us begin with this one. Of course you know what it is?" "**Clay.**"

"That is right. Clay is very useful. I think you can tell me some of the things we make of clay." "**Bricks, flower-pots, cups** and **saucers, plates** and **dishes, basins** and **jugs** are made of clay."

"Do you know where clay comes from?" "It is **dug up out of the ground.**"

"Quite right. I have here something else that was dug up out of the ground. What is this?" "**A carrot.**"

"Can you tell me what makes the carrot a different thing from this piece of clay?" "The carrot is a plant, it lives and grows in the ground. **The clay is not a plant; it does not live and grow. It never was alive.**"

"That's right. Now I want you to learn a new name. Clay is dug out of the ground, but it does not live and grow in the ground. It is not a plant. We call it **a mineral.**

"Here is something else which you have seen before. What is it?" "It is a lump of **chalk.**"

Let the children mention the use of chalk for writing and drawing on the black-board. Lead them to talk about the use of **mortar** *in building a brick wall. Tell that this* **mortar** *is made of* **lime,** *and that the lime is got by burning a* **hard kind of chalk** *called* **limestone.**

"Chalk, you see, is another very useful kind of stuff. Can you tell me where chalk is found?" "It is **dug up out of the ground** like clay."

"What shall we call chalk then?" "**Chalk is a mineral.**"

"Now look at this lump. It is not white like chalk; it is black. Of course you know what this is?" "It is **coal.**"

"You all know how useful coal is. It is useful because it will burn. We use it to make our fires. Will clay and chalk burn too?" "No, they will not burn."

"Can you tell me where the coal comes from?" "It is **dug up out of the ground.**"

"What is coal then?" "Coal is **a mineral** like clay and chalk."

Show the rough piece of slate next, and, side by side with it, one of the school slates. Lead the children to mention some of the uses of slate.

"Slate, like all these other things, is **dug up out of the ground.**

"What shall we call slate then?" "**A mineral.**"

"Now I have something else, quite different from any of the things I have shown you. What is it?" "A lump of salt."

"Salt, you know, is another very useful thing, and like the other things we have seen, it is **dug up out of the ground**; it is **a mineral.**

"All the salt that you see is white like this lump, but I have another piece of salt here, just as it was dug up. We call it **rock-salt.**"

Show the specimen of rock-salt, side by side with the lump of common salt. Let the children taste it to be sure that it is actual salt. Promise that some day they shall learn how the brown shiny-looking stone is changed into the white salt which they see every day.

Deal next with the specimens of stone. Lead the children *to tell of the uses of stone in paving our roads and streets, and building houses, churches, schools, and other great places.*

"There are many kinds of stone. All of them are very useful. Some kinds of stone are very beautiful and cost a great deal of money.

"Every sort of stone is **dug up out of the ground.** What shall we say about stone?" "Stone is **a mineral.**"

Show some sand and gravel. Tell that these are only little pieces of stone. Perhaps some of the children have been to the sea. Lead them to talk of the sands. Tell that all that sand is made of tiny little bits of the rocks which have been broken away by the sea. Sand and gravel are **minerals.**

Lastly, show as many things as possible made of the common metals—iron, lead, copper, tin, zinc. Tell the names of the metals, and explain that all of them were dug up out of the ground. But they were not dug up as we see them now. Show a specimen of one of the ores—say iron-ore. Let the children handle and examine it. It is like a very heavy stone. Explain that this rough-looking stone contains iron; it is the iron in it that makes it heavy. We call it iron-stone, or iron-ore. Iron, lead, copper, tin, and zinc are all dug out of the earth in the form of rough-looking lumps of stone like this.

"What shall we call them?" "**They are all minerals, because they were dug out of the ground.**"

"Do you know what this is?" "**A sovereign.**"

"And this?" "**A shilling.**"

"And this one?" "**A penny.**"

"What is the sovereign made of?" "It is made of **gold.**"

"What is the shilling made of?" "It is made of **silver.**"

"Gold and silver, like all the things we have on the table, **are dug out of the ground. They are minerals.** Our pennies, half-pennies, and farthings are not made of gold and silver; but the stuff of which they are made was also dug out of the ground. So they are **minerals** too."

Lesson XVI

CLAY

I. Introduction

Show the lump of clay, and proceed to elicit all that the children can tell about it. It was dug out of the ground, but it is not a plant. It is a mineral. It is a thing without life; it did not grow in the ground. Lead them to name the other common minerals which were mentioned in the last lesson—chalk, sand, gravel, iron-stone, slate, coal, lead, tin, copper, and so on. **They are all dug out of the ground.**

"Then as these things are got from the ground, does your father go into the garden, or into some field and dig them up as he wants them?" "No."

"You are quite right. When men dig deep holes in the ground, they don't find all these minerals there mixed up together. If your father dug a hole in the field close by, he would most likely find below the soil or mould, some **sand,** and if he dug out all the sand, he might perhaps find under that some **gravel.** When he had dug through all the gravel, he would be almost sure to come to some **clay.** Below the clay might be **more sand, more gravel,** and perhaps **chalk**: and a long way down he would come to **hard rocks,** and it may be **iron-stone** or **coal.**

"What I want you to remember is, that if there were fifty men digging fifty holes in that field they would all find exactly the same things, one after the other, as they dug down, because the minerals **always lie in beds or layers, one on the other,** just like this pile of books. We can't get at one bed without digging through all the beds above it.

"Now suppose we leave all the other minerals and think only about clay. Clay, you know, is a very useful mineral."

Lead the children to talk about clay as the material for making bricks, tiles, and chimney-pots for houses; flower-pots and other things for the garden; and crockery ware of every kind for our daily use. Extend their list so as to show them that clay is one of the most useful of the minerals.

Proceed then to explain that this useful mineral—clay is found, as a rule, **very near the surface of the ground,** *so that it can always be got without much trouble. There is plenty of it, too, for* **clay is found almost everywhere,** *and the clay beds usually extend for many many miles.*

II. CLAY IS PLASTIC

"As clay is so plentiful, and so easy to be got, we ought to try and find out what it is that makes it useful."

Break up the lump of moist clay into small pieces, and pass them round the class for examination. Let the children pull, twist, roll, and mould their pieces into various shapes.

Lead them to tell that they can do all this because **the clay is soft; it yields to the touch.**

Deal in the same way with a handful of wool, or a silk handkerchief. This is soft too; it yields to the touch.

"Now I want you to take the piece of clay and squeeze it tightly in your hand. I will do the same with this wool. That will do. Now let us open our hands all together. What do we see?

"I can squeeze the wool in my hand just as well as you can squeeze the clay. They are both soft. But as soon as I open my hand the wool springs back again to its old shape and size. What do we say about the wool, then?" "The wool is elastic."

"Quite right. Now look at your pieces of clay. Have they gone back to the same shape as they were before you squeezed them?" "No; they are just as they were when we squeezed them in our hands."

"I want you to keep this in your mind, because I have here a lump of clay which I squeezed up in my hands when it was moist and soft, and you can see that it is now exactly the same shape as I made it then, although it is as hard as a stone.

"You are now going to learn a new word which means all this. We say that **clay is plastic.** It means that **we can make it up into any shape we please** when it is soft and moist, and it will keep that shape when it gets hard.

"I think you will now see why clay is so useful to us. Men can mould the clay into bricks, cups and saucers, basins and dishes, and all sorts of things while it is soft and moist, because clay is plastic; and when it gets dry and hard it keeps the shape they give it."

Impress upon the children that the usefulness of clay is due to the very property that would make other things, like india-rubber and sponge, altogether useless.

The lesson should not be concluded till the beautiful contrast between the two properties is brought clearly into view—india-rubber, elastic; clay, plastic. Both these things useful. Why?

Lesson XVII

THE GUM BOTTLE

Show the gum bottle, and call upon the children to say what it is. Pour a little of the gum into a saucer, and lead them to tell that because it flows about, and can be poured out in this way, **it is a liquid.** *Show some water in another saucer. Point out that although the gum flows about in the saucer as we move it, it does not flow so readily as the water. It is* **a thicker liquid** *than water.*

"What use do we make of gum?" "We use it **to stick things together.**"

"Very well. I have here two sheets of paper which I want stuck together. You may come and do it, Harry, and then we shall see how you use the gum."

Let him dip the brush in the gum, and smear it over the edge of the paper, so that all may see.

"What must be done next, Harry?" "There is nothing else to do but press one piece of paper on the other. When the gum dries the two pieces will be stuck fast together."

"Suppose I try to stick two other papers together with some water out of this saucer, as you have stuck these two with gum.

"Do you think I could do it?" "No; **water would not make the paper stick.**"

Let one of the children try to do it, so that they may see the difference.

The first two papers are by this time stuck fast with the gum, but water will not make the others stick together.

"Let us look at this gum and see what we can learn about it. Dip one of your fingers into the water and another into the gum. Both fingers are wet, you see. That is, some of the gum and some of the water remain on the fingers.

"Now put your thumb and each of those fingers together and tell us what difference you notice." "**Gum is sticky:** it tries to stick my finger and thumb together; but **water is not sticky.**"

Show the child that the gum sticks so fast to his finger, that it gives him some trouble to remove it. He cannot wipe it away with his handkerchief, as he can the water on the other finger. He can only get rid of it altogether by washing his hand.

"Now I think you will understand why we use gum and not water to stick paper together. Gum is sticky itself, and **it makes things stick together.**

"I am going to tell you a hard word, which means just the same as our little easy word sticky. Instead of **sticky** you must learn to say **adhesive. Adhesive means sticky. Gum is adhesive:** it makes things stick together. **Water is not adhesive.**"

"Do you know what else I could have used instead of gum to stick the paper?" "**Paste** will stick paper together."

"Quite right. Here is some paste. Put your finger into it. **It feels sticky,** just like the gum."

Use the paste to stick some paper together, and lead the children to tell that **paste, like gum, is adhesive.**

Show next a common postage stamp and an envelope. The envelope has to be closed up, and the stamp has to be fastened to it before we post it. Call attention to the **smooth, shining appearance** *of the back of the one, and the edges of the other.*

Tell that **this shining stuff is gum,** *which has been spread on them and then left to dry. We have only to* **wet this gum** *to make it adhesive, so that* **it will stick fast.**

Set the children to try and open a closed envelope, or remove the stamp from it, and they will see how very fast it sticks.

Say a word next about the carpenter. He wants to **join pieces of wood** *together. Gum and paste would not be strong enough to make wood stick fast. What does he use?*

Show the **glue-pot** *and* **glue.** *If time permit, melt the glue on the fire, and show it in its liquid state. Stir it about to show the children its sticky nature.*

"**Glue is adhesive,** we use it **to stick wood together.**

"We have several times in our lessons spoken about the bricks and **mortar,** of which our houses are made. Did you ever see the men make their mortar? If so, you know they mix it into **a sort of paste,** and lay it between the bricks. The mortar makes the bricks hold together, **because it is adhesive. It makes them stick fast.**

"So then **gum, paste, glue,** and **mortar are all adhesive.** They make things stick together."

LESSONS ABOUT MYSELF

Lesson XVIII

THE BRAIN

I. INTRODUCTION

Bring a boy to the front and call attention to his head.

"You can all tell me, children, what is the name of this part of Harry's head?" "The face."

"And what is this part called on which the hair grows?" "The skull."

"Yes; and this skull is really **a big, hollow box.**"

Take a tape and pass it round the boy's head from the brows, across the ears, to the nape of the neck. Tell that all that part of the head above the tape is the skull.

Press the boy's skull all over, and lead the children to tell that it is hard, because it is **made of bone.**

"Now I want you to think. Here we have a strong, hollow box **closed in** on all sides **by hard bones.** No one can get at the inside. It is like **a very strong box** that has been locked up.

"What do we use strong boxes for?" "We keep things in strong boxes when we **want to take great care of them.**"

"Quite right. This will tell you why we have a strong, bony box like this skull. **The most important part of the whole body** is inside this skull. It is called **the brain.** It is put inside this box with hard, strong bones all round it, so that **it may not get hurt.**

"Even inside this strong box the brain is so tender and so easily hurt that a blow on the skull is enough to kill a strong man."

II. THE WORK OF THE BRAIN

"I am going to explain to you some of the work the brain does for us; but we must first learn a little about the brain itself and what it is like."

If a sheep's brain could be obtained from the butcher, it would greatly add to the intelligent grasp of the subject. Failing that, a picture should be shown.

"The brain **fills the whole of the box.** It is not the same kind of stuff as the flesh of the body. It is much softer than the flesh; and is of a pinkish-white colour.

"It sends out in all directions, through the body, **very tiny, thin strings,** made of this same pinkish-white stuff. These strings are called **nerves.** There are some of these nerve strings **in every part of the body,** but they are too fine for us to see.

"Now we will try and find out what the brain and these nerves do for us."

1. **The brain gives us the senses.**

"Let us begin by thinking about our eyes."

Lead the children themselves to talk about the structure of the eye-ball, with its window and curtain. They will tell that we see, because the light enters the ball through the pupil.

"Yes; that is what little boys and girls could tell me, but I want you to know more than that now. Some of those **nerves from the brain enter the eye-ball** at the back, and spread themselves all over the inside of the ball. When the light shines in at the pupil, **it falls on these nerves** at the back, and then we see. If there were **no nerves in the eye-ball** there would be **no sight.** We should be blind. It is **the brain,** you see, after all, which **gives us sight.**"

Pass on, in a similar way, to consider the ear. Assist the children to tell all they can about its structure—the outer ear to catch the sounds; the passage through which the sounds pass; the drum; the inner ear. Tell that all these wonderful parts of the ear would be quite useless without the brain and its nerves.

"Some of the **nerves from the brain pass into the inner ear** and spread themselves over it. When the drum carries the sound into the inner ear, **the nerves** there **catch it up** and **carry it to the brain.** Then we hear the sound. Without the brain and its nerves we could hear no sounds. We should be quite deaf."

Deal in precisely the same way with the other senses of **tasting, smelling,** *and* **feeling.** *Show that in all of them it is the* **brain that does the work** *by means of its nerves.*

2. **The brain is the master of the body.**

Put the children through one or two arm-practices by the word of command, and then proceed to talk about what they have been doing.

"Why did you all move your hands and arms about in that way? Let me tell you. I gave the order. Your ears caught up the sound. The nerves carried it to the brain. **The brain told your arms to move. It is the brain,** you see, **that does it all.**"

Lead them next to think so far as they can of the work that is always going on inside the body—the **heart** *always* **pumping** *blood along; the* **lungs** *always* **breathing**; *the* **stomach** *always* **turning the food into blood.**

Tell that the brain is the master over all these parts of the body. It sends some of its nerves to all of them, and with the help of the nerves it watches over them and **keeps them at work.** *They would not work if there were no brain to watch over them.*

Picture the heart or the lungs, if the brain were to leave them to themselves for a few minutes. **Their work would stop.** *We should die at once.*

"It is **the brain that keeps the body alive,** by making the other parts do their work."

3. **The brain makes us clever.**

Picture the children in school learning their lessons, thinking about what they have learned, and repeating it from memory afterwards.

Tell that it is **the brain that does it all.** *They* **learn** *with their brains; they store up in the brain what they learn,* *so that* **they may remember it afterwards.** *If they try, their brain will help them to grow up clever men and women.*

"It is easy to see now why this wonderful brain is packed away in a strong box of bone."

Lesson XIX

THE SKIN

I. INTRODUCTION

COMMENCE by leading the children to tell all they know about the skin as the outer covering of the body. The bones and the red flesh, of which the body is made, are underneath the skin. The skin covers them all over everywhere, and takes care of them.

Remind them, too, that the blood is constantly flowing along in the tiny blood-pipes, **just under the outside skin;** *but the skin does not let the blood come through and flow away out of our bodies.*

Lead them to tell that if we cut the skin, or even prick it, the **blood begins to flow at once.**

"**We could not prick the skin,** even with the finest needle, in any part of our body, **without making the blood flow.** This shows us how very close together those little blood-pipes are placed under the skin."

II. THE SENSE OF FEELING

"Suppose I ran a pin or a needle into my finger without knowing it. Would there be anything to tell me at once what I had done?" "You would **feel a sharp, smarting pain.**"

"Yes, I should; I could not prick the skin on any part of my body **without feeling that sharp pain.** You all know how painful it is if you cut your finger.

"But there are some parts of our body which we can cut without causing any pain. Can you tell me what I mean?" "**The hair.**"

"Of course. Boys and girls do not cry out with pain when the hairdresser cuts their hair with his scissors. It does not give them any pain at all.

"Can't you think, too, of some other parts of the body which we often cut?" "**The nails** on our fingers and toes."

"Quite right; and you know we do not feel pain when we cut them.

"Just think again. Do our nails and our hair bleed when we cut them?" "No."

"**They do not bleed.** That is because there are **no blood-pipes,** and **no blood in them,** as there are in the skin.

"Now let us go a step further. The least prick on any part of our skin gives pain. We can **feel the slightest touch** anywhere on the skin; but we can actually cut the hair and the nails without feeling it at all.

"You will not understand this till you think of **that wonderful brain** once more.

"What do we call those **tiny threads which the brain sends out** through all parts of the body?" "**The nerves.**"

"Quite right. You must remember, then, that some of these nerves are sent **to the skin.** They spread themselves about through the skin. There are so many of them, and they are so close together, that we cannot prick the skin anywhere **without touching one of them.** It is that which causes the little smarting pain which we feel."

Tell that these nerves are thicker in the skin of the hands, and especially round the tips of the fingers, than anywhere else.

Lead the children to think of the many ways in which people use their hands; of the great variety of tools men use in their work. Show how important this keen sense of touch is in handling things properly.

"In our lessons, from the very first, we have had to learn about some of the things by feeling them. Can you tell me what we can learn by feeling things?" "We learn whether things are **hard** or **soft, rough** or **smooth, tough** or **brittle, sharp** or **blunt, hot** or **cold, wet** or **dry**; and we can also tell **the shape of things** by handling them."

"You know that if we drop something very small on the floor we use **the finger and thumb** to pick it up.

"You know too that, if you want to feel something very carefully, you rub **the tips of your fingers** over it.

"Do you know why? I will tell you. It is because there are **more nerves,** and they are placed **closer together,** round the tips of the fingers than anywhere else.

"Remember we cannot feel anything with our **nails** or our **hair.** The reason is that these parts of the body **have no nerves**; just as we have seen that they have no **blood-pipes** and **no blood** in them."

Lesson XX

MORE ABOUT THE SKIN

I. INTRODUCTION

INTRODUCE the lesson by leading the children to talk about their games in the playground. Select a game that requires more than usual exertion; let the children tell in their own way all about it; and end by asking them how they feel when the game is over. They feel very hot. They wipe their faces. Why? Their faces are **quite wet**—*in fact they are* **wet all over.** *Tell that, if they were to look at themselves in the looking-glass, they would see* **little drops of water** *all over their faces. We are going to have a chat about these drops of water now.*

II. The Pores of the Skin

"Let us begin by thinking about our lesson on the sponge.

"What is the first thing you notice when you look at a sponge?" "It is **full of holes.**"

"Do you know a better name for them than **holes.**" "**Pores.**"

"Quite right. What do we say about things that are full of 'pores' or holes?" "We say they are **porous.**"

"I want you to remember that the **skin,** all over our body, is **porous.** It is **full of holes.** The pores are much too small for us to see; but if our eyes were sharp enough to see them, we should find hundreds and hundreds of them on every little spot which you could easily cover with the tip of your finger."

A very interesting, pleasing, and instructive little experiment may be shown as follows:—Take a piece of common wash-leather. Tell the children that this wash-leather was made out of the skin of the sheep. The sheep's skin, like ours, is porous. It is full of holes; but they are too small for us to see. Pour a small drop of mercury on the leather, and squeeze it between the thumb and fingers. The squeezing breaks up the mercury into very tiny drops, and forces them through the pores in the leather, so that they may be caught in a saucer as they fall through. This will prove clearly to the children that there are **pores in the leather,** *although their eyes are not sharp enough to see them. Tell, again, that it is exactly the same with the skin all over our bodies. It is* **full of tiny pores.** *Afterwards proceed as follows:—*

"Now that you know about the pores in the skin, I shall be able to tell you where those little drops of water come from, when you get very hot. **They come from the pores.** Every little pore sends out these drops of water, till the whole of the skin feels moist. **The more you run and romp about, the more water oozes out all over the skin.**

"Do you know what we call this water?" "We call it **sweat.**"

"Yes; and there is another name for it—a harder one than that. We sometimes call it **perspiration.**

"Think for a moment about our lesson on breathing. What do we call those parts of the body, inside the chest, which do the work of breathing?" "**The lungs.**"

"What happens every time we breathe?" "We take in good, fresh air, and send out bad air."

"Quite right; and you know we should soon die if we could not breathe properly.

"Now I want you to remember that the **pores of the skin** are doing good work for the body when they send out that water—**the sweat. If the sweat could not get out of the body, it would soon make us very ill.**

"The sweat **is always coming** through the pores; it is this which **makes the skin feel soft, and smooth, and moist.** But you do not notice it till you romp about and make yourselves hot. Then you can see it in little drops all over your skin."

III. WE MUST KEEP THE SKIN CLEAN

Lead the children to think of the immense number of these pores all over the body. (There are upwards of **six millions of them altogether;** *but it would be quite useless to mention such numbers as these to children of their age. The teacher should use her own discretion to make the children form some notion of these vast numbers.)*

Tell that they would not be there, if they were not wanted. It is not right to stop them from doing their proper work. Tell how **the little holes are easily stopped up with dirt.** *We cannot help getting dirty. Boys and girls get dirty as they romp and play about; men and women get dirty with their work. If we want to be well and healthy, and to grow up to be strong men and women, we must* **never be afraid of soap and water.** *That is why mother baths the children all over,* *when they are too little to bath themselves. When they get big boys and girls, they must learn to bath themselves.*

SOME USEFUL ANIMALS

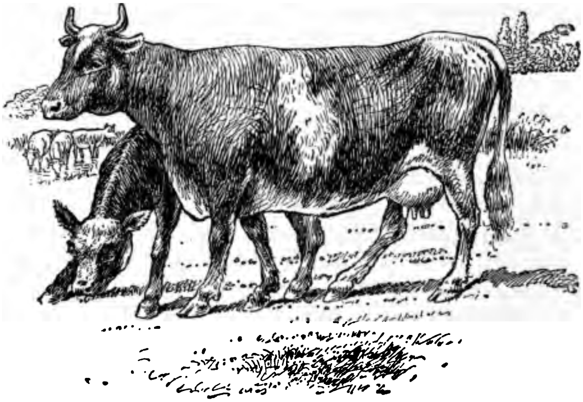
Lesson XXI

THE COW

I. Introduction

Show a picture of the cow, or a good model of the animal.

"You all know this animal, children. It is such a useful animal that we find it everywhere we go. If we go for a walk in the country, we find cows in the fields, but even in the busy towns we still see them, for we could not do without them. As you have all seen this useful animal, I want you to try and tell me all you can about it."



By careful questioning, and by referring to the picture, lead *the children to describe the build of the body and the general appearance of the animal. It is a* **large, thick-set animal,** *with* **short, stout, strong legs,** *just fit to support so heavy a body. It has* **a thick skin,** *which we call* **a hide**; *the hide is* **covered with close, smooth hair.** *Let them tell that all cows are not the same colour. Some are brown, some black, some white, some red, and some spotted.*

Lead them next to talk about the head. It is not a large head, but the forehead is broad, and it has **a broad, square mouth,** *with* **a large, loose upper lip.** *Its* **eyes** *are* **large** *and* **gentle-looking,** *and they are placed at the sides of the head. The cow is a gentle creature. It loves to lie quietly in the green fields. It would not hurt us although it is so big and strong.*

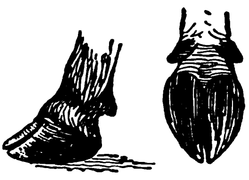
Point out the **big, broad ears,** *which are placed far back on the head, and behind them the two* **smooth, round, curved, pointed horns.**

Call attention next to **the long tail** *with the* **tuft of hair on the end.** *Some of the children may have seen the cows in the fields lashing their tails about on a hot day. Tell why they do this.*

"Now that you have told me all this about the cow, suppose we try and find out something which you have not noticed. We will begin with the feet.

"The cow's **foot** has **four toes,** but it walks only on the two front ones. Look at these two short toes behind. **They never touch the ground.**

"Each toe is covered with **a hard horny case,** which we call **a hoof.** The foot looks as if it were **split** or **cloven in two.** We call it a **cloven-hoof. Cloven** means **split in two.**



"Now I want to talk to you about the cow's mouth. It has **no teeth at all in the front of the upper jaw,** but instead of teeth there is **a thick hard pad** like leather. The teeth in front of the lower jaw **are very large and strong.**

"It has a **great long tongue,** and this, with its **loose upper lip,** helps the animal to hold the tufts of grass, while it bites them off with the strong lower teeth."

II. THE COW CHEWS THE CUD

Pass naturally now to consider the peculiarity in feeding. Lead the children to tell how the cow walks about in the field cropping the grass as she goes. Remind them that it does not stop, but bites off mouthful after mouthful, and after it has had its fill, it lies down in some quiet place to rest. But is it really resting?

"If we watch a cow lying down in the field, we always see the mouth moving as if it were chewing something. Can it be actually chewing? We never see the animal cropping any more grass as it lies there."

Tell that all the while it walks about and bites off the grass it **swallows it at once without waiting to chew it.** *The lumps of grass pass down its throat into a stomach, called* **the paunch.** *It leaves off cropping when this paunch is full, and then it goes to lie down. While it is lying down like this,* **the grass comes up** *in a very wonderful way into its mouth again* **to be chewed.** *This is what the cow is doing while it rests so quietly on the ground. We say it is* **chewing the cud.**

"The cow does not feed as we do. We chew our food before we swallow it. **The cow swallows its food without chewing it**; and afterwards **brings it up into its mouth again to be chewed.**"

III. THE USES OF THE COW

Lead the children to talk about milk and some of the uses we make of it. The cow gives us this milk. Point out **the udder** *from which the milk is drawn.*

Tell how the cows are brought in from the fields morning and evening to be milked. They seem to know the proper milking *time, and always wait on the look-out for the boy who fetches them in.*

Picture the cows in the field in the evening waiting to be brought in—some with their heads over the gate, all of them restlessly lashing their long tails about, and every now and then **lowing,** *as if to call the boy, should he happen to be late. Follow them as they walk sedately up the lane to the farm-yard; and then show a picture of the milking-time.*

"Some of the milk is sent away, and we drink it, and use it in many ways every day.

"But the farmer does not send all his milk away. Some of it is taken into the **dairy,** and made into **butter** and **cheese.**

"The cow does all this for us **while it is alive**; and in some countries it is used **to draw waggons, carts,** and **ploughs,** just as we use horses.

"But the cow is more useful to us still **after it is dead.**

"Its flesh is a valuable food, which we call **beef.**

"What is the flesh of the young cow—the calf—called?" "It is called **veal.**"

"Its **skin** is made into **leather,** and even **the hair** is turned to good use in many ways; its **bones** and **horns** are made into **knife-handles, combs, buttons, spoons,** and many other useful things; **its fat** gives **tallow** for making **soap** and **candles**; and even the waste cuttings from the **skin, horns,** and **hoofs** are useful for making **glue.**

Lesson XXII

THE SHEEP

I. Introduction

Show a picture of sheep and lambs in the field, and lead the children to talk about them in some such way as follows:—

"I hope you have not forgotten our lesson on the cow, children.

"Here is a picture of another very useful animal. Do you know its name?" "It is a **sheep.**"

"Yes, this is the mother sheep; we sometimes call it **a ewe.** Do you know what we call her little one?" "We call it **a lamb.**"

"The sheep, like the cow, is such a useful animal that we meet with it everywhere. In the country we can see hundreds and hundreds of sheep feeding together in the green fields.

"Do you know what we call a great many sheep all together?" "We call them a **flock of sheep.**"

"Now let us look at our picture, and see what we can learn about this useful animal."

II. THE SHEEP AND COW COMPARED

Lead the children to compare the sheep with the cow, and tell that it is a small animal by the side of that. Call attention to its pretty, gentle face, with its timid-looking eyes. Tell what a timid, easily frightened creature it is. It will run away if only a little child goes near.

"Now think of the cow. What can you see on the cow's head which you cannot see on the head of the sheep in the picture?" "The cow has horns; the sheep has no horns."

"Well, you are quite right. Our sheep in the picture is the mother sheep. We called it a ewe. It has no horns. **The male sheep has horns.** We call it **a ram.**

"Now tell me what kind of covering the cow has for its body." "The cow has a very thick skin which we call a hide; and the hide is covered with close, smooth hair."

"Quite right. Can you tell me what the sheep has for a covering?" "The sheep has **a thick coat of wool.**"

Tell that the farmer shuts his cows up in a nice, warm shed during the cold weather; but the poor sheep always lives out in the open air night and day, winter as well as summer. This thick coat of wool keeps it warm, so that it does not feel the biting cold weather.

Lead the children next to talk about the way in which the cow feeds. Some of the children may perhaps have seen the sheep feeding in the fields. Let them tell what they have seen. Show them that the sheep and cow feed exactly in the same way. They both **chew the cud.**

Tell that both have the same kind of mouth and teeth, and that both of them swallow the grass just as they bite it off. **When they have filled their paunch, they bring the grass up again into their mouths to chew it.**

Proceed next to examine the feet. Show that the feet of the sheep are exactly like those of the cow. They are **cloven hoofs.** *Let the children themselves tell what is meant by a cloven hoof.*

III. Uses of the Sheep

Lead the children to tell that, when the winter comes, they put on thick, warm clothes; and they are very glad to wear them as long as the cold weather lasts. But what do they do when the cold is all gone and the weather is warm and bright again? They leave off their thick, heavy clothes, and put on lighter, thinner things instead. It would make them ill to wear thick clothes in the warm weather.

"The sheep too wants its thick, warm coat of wool during the cold weather, but it is glad to get rid of it when the warm days come again. A thick coat in the hot, summer weather would make the sheep ill.

"As the spring comes on, **the wool begins to get loose** and fall off; and **the farmer then has it all cut off.**"

Show a picture of sheep-shearing. Describe the work. The first business is to wash the sheep, for they have made their woolly coats very dirty by lying about on the ground all through the winter. Tell how this is done. Explain that after they *have been well washed in the stream, they are turned out into the green fields to run about and dry themselves.*

Show **the shears** *that are used for cutting off the wool, or make a sketch of them on the black-board. They are a pair of big scissors.*

Tell how quietly the sheep lie while their coat is being cut off. It does not hurt them any more than it hurts a boy when he has his hair cut.

Tell that the wool which is cut from one sheep is called **a fleece of wool.**

"But why does the farmer cut off the wool? Is it of any use?"

Lead the children to think of our nice, thick blankets, which keep us warm at night; of our thick, comfortable coats and cloaks, which we are glad to wear in the cold weather, and so pass on to notice the use we make of wool for our clothes.

"The sheep, you see, is very useful to us while it is alive. It gives us **its warm coat of wool every year** to make our clothes.

"Some of you have perhaps seen a great many sheep being driven into the butcher's shop to be killed—poor little things.

"Why should we kill them?" "We want their flesh for our food."

"We call it **mutton.** You have often seen dead sheep hanging up in the butcher's shop. So, you see again, the sheep is useful after it is dead."

Tell that, besides this, **the sheep's skin** *is made into* **leather** *for many useful purposes. Show a piece of* **wash-leather.** *This is made from the skin of the sheep.*

Its **horns, hoofs,** *and* **the waste cuttings of the skin** *make* **glue;** *and its* **fat** *is boiled down to make* **tallow** *for soap, candles, and many other useful purposes.*

Lesson XXIII

THE HORSE

I. Introduction

Show a picture of the horse; or, if possible, a model of the animal, and commence as follows:—

"You all know this noble fellow, children. It is a horse. Most boys and girls see hundreds of horses every day of their lives.

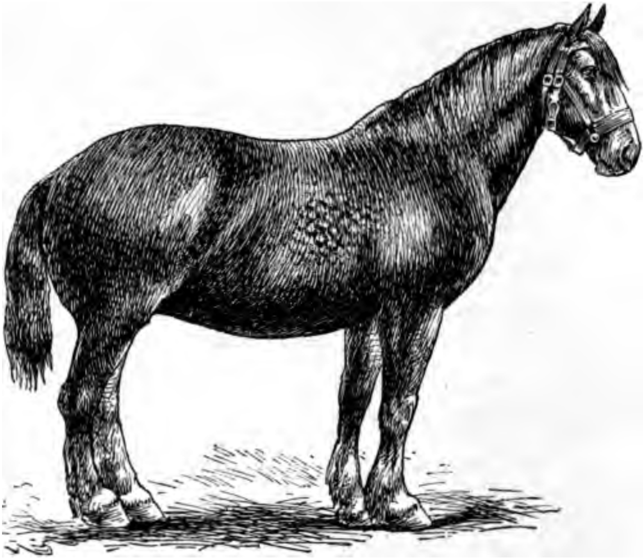
"Now I want you to think about the horse, and see what you can find to tell me about him.

"In the first place, what are all the horses doing which you see in the streets every day?"

In this way lead the class to tell, from their own observation, the use we make of the horse. They see the sheep and cows in the fields leading a quiet life, with nothing to do but crop the sweet fresh grass all day. **Whenever they see the horse he is at work.** *We use him to draw heavy loads on waggons, carts, and carriages. Why? Because he is* **a large, powerful animal.**

Show that his great strength would be of little use—it would make him dangerous—if he did not know how **to obey his**

master. *Lead them to tell how* **quiet and gentle** *he is at his work; how he* **seems to know everything** *his master says to him; and* **does whatever he wishes** *him to do. At a word from him, the horse starts off, or stops; he even knows when to go faster or slower. He seems to understand it all. It is this which makes the horse so useful to his master.*



Tell that a good master does not whip his horse, but pats and strokes him, and speaks kindly to him. The horse is such a sensible fellow that he soon knows those who are kind to him, and works all the harder for them.

"The horse, you see, is a very useful animal, although he neither gives us milk while he is alive, nor do we eat his flesh for food after he is dead.

"All horses are not alike. What kind of horses do you see drawing heavy loads on great waggons?" "They are very big, and they look very strong."

"Quite right. We call these **cart-horses.** They are very powerful creatures, just fit for the hard work they have to do.

"Some horses are kept for riding. The hardest work they have to do is to carry their master on their back. These horses are not big and powerful like the cart-horse. They have long slender legs, and can trot and gallop very fast."

Tell that in some countries the people have no horses; and there they use oxen to do all the hard work. Picture oxen yoked to a cart. How strange it would look to us; yet it is quite a common thing in some lands. But the ox could not do as much hard work as the horse; it is not so large and strong as the horse.

II. Horse and Cow compared

"Now let us think about the horse and cow side by side, and see what other points of difference we can find. We will begin with their coats.

"What kind of covering has the cow?" "It has a very thick skin, or hide, covered with short, coarse hair."

"The horse has **a hide** too, but it is not so thick as the cow's hide, and **the hair** which covers it is **soft, smooth,** and **glossy.**"

Let the children themselves tell that horses are not all the same colour. There are **white, black, bay, dun, grey,** *and* **dappled horses.**

"Now look once more at the horse. Do you remember seeing something on the cow's head which you do not see on the head of the horse?" "The cow has horns, **the horse has no horns.**"

"Quite right. Now look again and I think you will see that the horse has something which the cow has not?" "**The horse has some long hair hanging over his neck**; but the cow has none."

Explain that this is called his **mane.** *The cow has no mane.*

"Let us think next about the tail. What can you tell me about the cow's tail?"

Lead them to describe this long, thin tail, covered, like the rest of the body, with short, coarse hair, and having a tuft of longer hairs at the end.

"The horse's tail is not at all like this. It is short, thick, and pointed, and is **covered with long, stiff hairs,** which sometimes hang down to the ground."

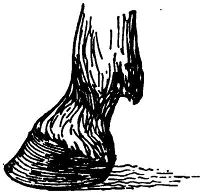
Show a specimen of the tail hairs.

"We must now look at the horse's feet; but, as before, I shall want you to tell me what you remember about the cow's feet."

Lead the children to give their own description, assisting them of course where necessary; after which call attention to the foot of the horse.

"**The horse's foot is a hoof** too; it is covered with a strong horny case. But it is **not a cloven hoof;** it is **all in one piece.**"

Remind the children that the horse has to draw heavy loads over rough, stony roads. This is why we nail iron shoes to his hoofs, to prevent the rough stones from wearing them away.



Some of the children may have watched the work of shoeing the horse. Lead them to describe how it is done. Show a horse-shoe and some nails, if possible. Explain why it is that all this cutting, nailing, and burning the hoof can be done, **without giving the horse pain.** *Compare the hoof with the substance of our nails. It does not give us pain when they are cut.*

"The horse eats the same food as the cow; but **the two animals do not feed in the same way.**"

Picture them feeding in the same field, and lead the class to describe clearly the way the cow feeds—she chews the cud, and so does the sheep.

"**The horse does not chew the cud.** He bites off his food and chews it mouthful by mouthful before he swallows it. He does not bring it back into his mouth again to chew it."

III. USES

"We have seen how useful the horse is while he is alive; but when he is dead every part of his body is put to some good use.

"The **skin** is made into **leather**; the **hair** is used for **stuffing cushions** for chairs and sofas; the **hoofs** and **waste cuttings** from the skin and bones are made into **glue**; the **bones** themselves are made into **articles of daily use**; the **fat** is used for making **soap**; and the **flesh** is sold by the cat's-meat man."

Lesson XXIV

THE DOG

I. INTRODUCTION

COMMENCE by leading the children to talk about the animals of their former lessons—all of them very useful to us. One during its life-time gives us milk; another every year parts with its warm coat to make our clothes; another performs all sorts of hard work for us. The bodies of all of them, after they are dead, are useful in so many ways that no part of them is wasted—all is turned to some good purpose.

"We are now going to talk about an animal that does none of these things for us, and yet he is so useful that we look upon him as one of our best friends."

Show pictures of the various kinds of dogs.

"What a lot of animals! Do you know what they are? They are all dogs, although no two of them are alike."

Lead the children to tell that, in the first place, they are not all the same size.

"Look at this big fellow. He is stronger than a man. Here is another so small that you could easily take him in your arms and carry him.

"Can you see anything else which makes some of them different from others?" "Some of them are covered with **long, shaggy hair,** others have **smooth coats.**"

"What else do you notice?" "They are not all the same colour."

II. What the Dog is like

1. **The body and legs.**—*Lead the children to tell, by reference to the pictures, that the body as a rule is long and deep-chested. Point to the greyhound with its long, slender body. Compare this with the shorter, thicker build of the bull-dog.*

Call attention to the legs. They are slender, but very strong. They are made for running. **Dogs are good runners.**

"Now let us notice the feet. Do you know what we call them?" "We call them **paws.**"

"I think you can tell me something about the dog's paws. How many toes are there on each paw?" "There are **five toes** on each **front paw,** and **four** on each **hind one.**"

"Do you remember anything else about the dog's paws?" "They are **padded underneath** like the paws of the cat."

"That reminds me that we cannot hear the cat as she runs along, but the dog's feet make a noise as he runs. Can you tell me why this is?" "**The dog cannot draw his claws back** as the cat can. They rub the ground at every step he takes. **They are always blunt.**"

Remind the children of the dog's habit of burying bones. He scratches the hole in the ground with these blunt claws. They seem to be made for this purpose.

2. **The Head.**—*Call attention to the long, pointed head of most of the dogs. Show that this is not the case with the bull-dog; he has a short, square muzzle. All dogs have* **strong jaws** *and* **very sharp teeth.** *They are so strong that they can crush bones with them.*

Notice the **four large holding** *or* **tearing teeth** *in front. Lead the children to tell that the cat has exactly the same kind of teeth. What use do these animals make of their holding teeth?*

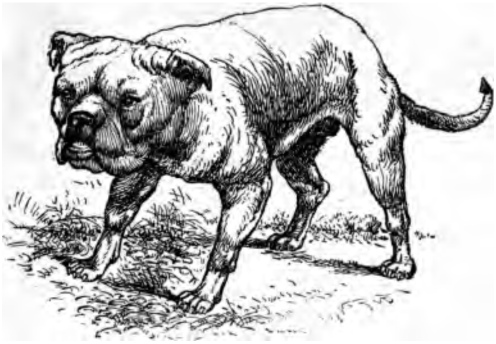
Speak next of the nose, and its **keen sense of smell.** *It is mostly by this sense of smell that the dog knows his master. Tell that the dog's nose always feels damp and cold when he is in good health.*

Refer now to the pictures, and show that **the ears** *of all the dogs are not alike. Some are* **erect,** *and some* **hang down.** *Tell that their sense of hearing is always very sharp. A dog will often prick up his ears and begin to bark although we ourselves may not have heard the slightest sound.*

III. HABITS AND USES OF THE DOG

"We have already said that the dog is very useful to us. Let us see why we keep dogs."

1. **To guard the house.**—"People like to keep a dog to take care of the house. He knows his master and all who live in the house, but he does not like strangers. His sharp ears and his keen sense of smell tell him at once if any strangers come, and he begins to bark to let us know."



2. **To kill rats.**—"Some dogs are very clever at catching rats. We call them **terriers.**"

Point out the kind of dog in the picture.

"No one likes to have rats about the house, so that these dogs are very useful in their own way."

3. **To mind the sheep.**—"Look at this dog, we call him the **sheep-dog.** He is perhaps the cleverest of all dogs. He helps the shepherd to take care of his sheep."

Remind the children of the timid nature of the sheep. They are always likely to stray away and get lost. Picture this clever dog running round the flock, jumping at them and barking to keep them from running away. He does not attempt to bite the sheep, but he seems to follow every look of his master, and never lets one of them go the wrong way. Tell some little story to illustrate the cleverness of the dog.

4. **To save people from drowning.**—"Here is another dog. What a great, handsome, noble fellow he

looks. He is the **Newfoundland dog.** He is a splendid swimmer. He has no fear of the water, and has saved many people from drowning."

2. **To kill rats.**—"Some dogs are very clever at catching rats. We call them **terriers.**"

Point out the kind of dog in the picture.

"No one likes to have rats about the house, so that these dogs are very useful in their own way."

3. **To mind the sheep.**—"Look at this dog, we call him the **sheep-dog.** He is perhaps the cleverest of all dogs. He helps the shepherd to take care of his sheep."

Remind the children of the timid nature of the sheep. They are always likely to stray away and get lost. Picture this clever dog running round the flock, jumping at them and barking to keep them from running away. He does not attempt to bite the sheep, but he seems to follow every look of his master, and never lets one of them go the wrong way. Tell some little story to illustrate the cleverness of the dog.

4. **To save people from drowning.**—"Here is another dog. What a great, handsome, noble fellow he looks. He is the **Newfoundland dog.** He is a splendid swimmer. He has no fear of the water, and has saved many people from drowning."

5. **To save people who are lost in the snow.**— "Here is another grand dog. He is the largest and strongest of all. He is the **St. Bernard dog.**"

Tell of his gentle, loving nature. Explain how he gets his name. Tell some little story of people who have been lost in the snow, and rescued by these noble dogs.

Lesson XXV

DUCKS, GEESE, AND FOWLS

I. Introduction

Commence by showing a picture of each. Call upon the children to name them, and tell that they are great birds. Explain that of all birds none are so useful as these three; "that is why I want you to know something about them."

Lead the children themselves to tell that while the ducks and *geese are very much alike, they are both very different in appearance from the fowls in the other picture.*

Explain that, although this is quite true, they must all be alike in some things, because they are all birds.

"Let us first notice some of the points in which they are all alike, and then we will find out where they are not alike."

Lead the children to pick out the points of likeness one by one. They are all clothed with feathers; they all have two legs; their two upper limbs form wings for flying; the head is small, and has neither ears, nose, nor lips; instead of soft lips, they all have a horny bill, and this bill serves all of them instead of teeth, for they have no teeth.

II. DUCKS, GEESE, AND FOWLS COMPARED

"So far they are all alike. Now let us see in what things they are not alike."

The bills.—"Suppose we begin with their horny bills. Look carefully at the bills of the birds in the picture. The fowls, you see, have **short, sharp-pointed bills**; the bills of the ducks and geese are **flat** and **broad.** I want to show you why this is."

Produce the specimen head of the fowl. Let the children feel the bill, and tell that it is **very hard and strong.** *Lead them to describe how the fowls feed, by scratching and picking in the ground. Tell that their hard, strong, sharp-pointed bills are meant for this very work.*

Now show the duck's head. Call attention to the **long, broad, flat, yellow bill.** *Open it, and show* **the fringe on the inside,** *and* **on the edge of the tongue.** *Tell that ducks and geese find their food by groping in the mud. These broad flat bills* **are like shovels.** *They shovel up the mud into their mouths, and then strain it out at the sides again; all that is good for food* **is kept in by the fringe** *round the edges.*

The feet.—"Now let us turn to the picture once more. I want you to look at the feet of these birds."

Lead them to tell that the duck's foot is exactly like the foot of the goose; but neither of them is like the fowl's foot. Point out that **the legs of the fowls** *are* **much longer** *than those of the ducks and geese; and hold their bodies up much higher from the ground. What a grand fellow the cock himself looks, and how he struts about on his long, strong legs.*

Show the specimen leg and foot of the fowl. Call attention to **the hard, tough, horny skin** *which covers it. Notice that the bones of the leg, too, are* **thick and strong**; *the foot has* **three long toes in front** *and* **one behind**; *and each toe has* **a strong, curved claw** *at the end of it. Tell again of the way these birds feed. Picture the hen and chickens awake and abroad in the early morning. Who wakes them, and tells them it is time to get up? See them all* **scratching in the earth with their strong claws,** *and picking about with their hard, sharp bills. What are they scratching for? They are finding worms, grubs, and insects in the ground. This is their favourite food. Picture the hen calling her little ones to the feast, when she scratches up a good fat worm.*

Show now the specimen leg and foot of the duck. Let the children themselves point out the difference between it and the fowl's foot. Tell that **the thick, tough skin between the toes is called a web.** *We say the foot is* **webbed.** *Notice again how short the leg is.*

"Have any of you ever seen a duck walk about? Next time you see one have a good look at it. It seems to roll about from side to side in a very awkward way. We say **it waddles** when it walks, and it **cannot run at all.** Would those feet be of any use for scratching in the ground for worms, grubs, and insects?"

Tell that ducks and geese are **just as fond of worms, grubs, and insects** *as the fowls are; but they do not scratch them out of the ground with their feet. Lead the children to tell that these birds get their food out of the mud with the help of their flat bills. Tell that there is always plenty of mud at the bottom of the ponds and lakes; and so lead up to tell of the swimming powers of these birds.* **Their webbed feet are made for swimming,** *not for walking. Picture them* *swimming in the water—nothing awkward about them then. Tell how they dive down to the mud at the bottom to get their food.*

This should lead to a brief comparison between the feathers of these water birds and those of the fowls. Tell of the **thick, close-fitting under-vest** *of* **down** *which these birds always have to keep them warm, even when they are swimming about in the icy water in the winter time. Fowls are not water birds,* **they have no such downy covering** *next to their skin.*

One very curious fact might be noticed here. When a dog comes out of the water after swimming about, his coat is dripping wet for a long time after. If we were to put a hen into the water, she would look as bad as the dog. When the duck or the goose comes out of the water its feathers are not wet. How is this? Tell that there is **a sort of oil in the body** *of these water birds, which greases their feathers all over, so that the water will not stay on them, but* **rolls off at once.**

III. USES OF THESE BIRDS

"We began our lesson by saying that no birds are so useful as these ducks, geese, and fowls. We sometimes call them **poultry birds.** Let us see why they are so useful."

Lead the children to tell of **eggs** *and the great use we make of them. Most of the eggs we use are hens' eggs, but ducks' eggs are very good. Some people like them better than hens' eggs. They are of a pale green colour.*

"These poultry birds, then, are useful to us while they are alive. Can you think of any other use we make of them?" "**We eat them** when they are killed. Ducks, geese, and fowls are very nice; peeple think them a great treat."

"What other use do we make of these birds?" "**We use their feathers.**"

Tell that the soft down of the ducks and geese, and the little soft feathers on the body of the fowls are used for **stuffing beds, pillows, and cushions,** *the large wing and tail feathers are used for* **trimming hats,** *and for many purposes. What a beautiful plume of feathers the tail of the cock makes!*

Lesson XXVI

THE HONEY-BEE

I. INTRODUCTION

COMMENCE by reminding the children of their last lesson on ducks, geese, and fowls. These animals are all alike in one respect—they all have wings and fly. What do we call them? Birds.

"Can you think of any other animals that have wings and fly?—not big animals like those birds, but tiny things.

"Ah, I see you know what I mean. What do we call all those little creatures?" "We call them **insects.**"

"Can you tell me the names of some of the insects?" "Butterflies, moths, flies, bees, wasps, gnats, and beetles are all insects."

"Quite right. I have some insects here that I want to show you now. You could not handle them, if they were alive, without hurting them; so I have got some dead ones to show you. They are pinned to this sheet of card-board, just as I pinned those pretty butterflies for one of our other lessons.

"Look at them. Perhaps you can tell me what they are." "They are **bees.**"

"Yes, they are; we are now going to see what we can learn about the bee. It is one of the most useful of insects."

II. THE BEE AND ITS HABITS

"First of all, I should like you to tell me why we call them insects."

Let the children examine the specimens. Lead them to point out the peculiar form of the body. It is made up of three parts—first the head, then the chest, and then a big part behind the chest. Point out that these three parts are almost separated from one another. The body looks as if it were cut through in two places. In this way lead up to the name **insect.** *It is just the same kind of body as we found in those butterflies.*

"I daresay some of you have seen the bees flying about in the fields and the garden in the summer time. Have you ever noticed where they go and what they do?" "They keep flying about from one flower to another."

The teacher should lead the children to describe as far as possible the visits of the bee to the flowers. Picture it alighting on a flower, and forcing its way in to the very bottom of the flower-cup. After a time it comes out again, and flies away to some other flower to do the same.

"Let us try and find out why the bee does this."

III. THE HONEY

Show the specimen of honey. Have it tasted. Let the children tell that it tastes very sweet—sweeter than sugar. Call upon them to tell what it is.

Explain that the bee gives us this honey. Tell that in most flowers there is a **little sweet juice or syrup.** *This sweet juice often lies at the very bottom of the flower-cup. The bees know it is there, and that is why they visit the flowers and push their way right into the middle of them. While they are there, they are very busy sucking up this sweet juice, and they go from flower to flower till they have got as much as they want.*

Tell that they do not eat this sweet syrup or honey themselves. They only suck it up into a little bag in their bodies, and carry it away to their homes. When they get there they give it all up, and **it is stored away,** *to serve as food for them in the winter when all the flowers are gone.*

Show next a well-developed flower of some kind. Call attention to the anthers inside. Let the children touch them, and point out the fine yellow dust, which adheres to the finger when they take it away. This is **the pollen** *of the flowers.*

Tell that the bees collect this pollen also from the flowers, and carry it home. They use it **to feed their young ones.** *It has been called* **bee-bread.**

IV. THE BEE-HIVE AND THE COMB

"We have spoken several times about the bee's home.

Perhaps you would like now to know what kind of a place it is."

Show a picture of a bee-hive, or draw a sketch of one on the black-board.

"People who keep bees give them a little house like this. It is called **a bee-hive.** A number of bee-hives are stood in a row on some benches in the garden near the flowers. In each little house immense numbers of bees live together. There is a little hole near the bottom of the hive, which serves as a door for the bees to go in and out."

Show now the specimen of the honey-comb. Tell that, as soon as the bees get settled in their hive, they commence to build row after row of little boxes like these. We call the row of little boxes **the honey-comb.** *They always build their boxes the same shape, with six sides. They build them with wax* **(bees' wax),** *which they make themselves from the food which they have eaten.*

Call attention to the specimen. Open one of the cells, and show the honey inside. Tell that these clever little insects make their honey, and store it away **in these boxes or cells,** *just as mother often makes jam and stores it away in jam-pots for the winter.*

"People who keep bees want the honey for themselves; so when the bees have filled their cells, their masters take away as much as they want, and leave them only enough to keep them till the winter is over."

V. What the Bee is like

Close the lesson with a brief description of the insect itself. Notice again the three well-marked divisions of the body. Point out the **two pairs** *of delicate, gauzy wings; and the* **six legs,** *three on each side.* **All insects have six legs.** *Show that both legs and wings are joined to the middle part of the body — the chest. Notice the fine hairs which cover the whole of the body and legs.*

How do we know when the bees are flying about? We can hear them **humming.** *Tell that this humming sound is produced* **by the movements of the wings** *in flight.*

Lesson XXVII

THE SILK-WORM

I. INTRODUCTION

SELECT some article worn by one of the children, a ribbon or something of the kind, and let it form the basis of the lesson.

"We are going to have a chat this morning about this pretty ribbon; but before we do so, I want you all to think over the different kinds of stuff of which your clothes are made.

"Take your pinafores first. What are they made of?" "Cotton."

"Where did the cotton come from?" "It grew in the seed-pod of the cotton plant."

"Now look at Harry's nice white collar. What is that made of?" "Linen."

"Where did the linen come from?" "It was made from the inner bark of a plant called the flax-plant."

"Both these things, then, came from plants. Look at his warm cloth-jacket. What is that made of?" "It is made of wool."

"Where did the wool come from?" "It grew on the back of the sheep."

"Now look at his boots. What are they made off?" "Leather."

"Where did the leather come from?" "It was made from the skin of the cow."

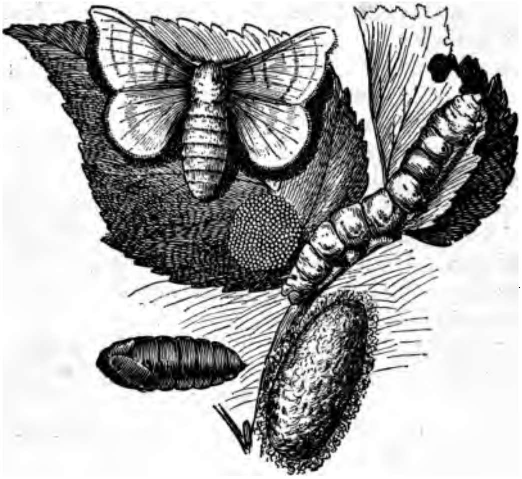
"This pretty ribbon which Mary has to tie up her hair is not made from any of these things. Can you tell me what it is?" "It is silk."

"Quite right; and now we will find out where the silk came from to make the ribbon. I don't think you could ever guess."

II. THE SILK-WORM MOTH

Procure (if the season permit and it be otherwise possible) some silk-worm moths, some eggs, and some silk-worms. Failing the actual specimens, a picture of these things must be shown. Tell that this beautiful, shiny, silk ribbon was made by little animals like these.

Show the moth itself first. Call attention to the **two pairs of wings** *covered with fine feathery hairs; to the body with its well-marked division into* **three parts**; *and to the* **three pairs of legs.** *Lead the children to tell that it is* **an insect.**



"Yes, it is an insect. What insect is it most like?"
"The butterfly."

"It is not a butterfly although it is so much like one; it is **a moth.** We call it **the silk-worm moth.**

"This moth is the mother insect. She lays the eggs for the new silk-worms, but she never sees her young ones, for she dies soon afterwards."

Show the eggs themselves. Notice what tiny little things they are. Tell that when these eggs are hatched, a tiny little black worm, about a quarter of an inch long, comes out of them.

III. THE SILK-WORM

"This little thing likes nothing so well as mulberry leaves. It will eat no other food if it can get them. They are its proper food. People who keep silk-worms always take care to have plenty of mulberry leaves to give them to eat.

"The worm feeds and grows very quickly, till at last it is as big as this one. We then call it by its proper name—**a silk-worm.**

"Look at it and tell me what it is most like." "It is **like a caterpillar.**"

Show one or two garden caterpillars, and let the children see that the silk-worm is not only like a caterpillar, **it is a caterpillar.** *The mother moth laid her eggs, but she would not have known her own babies if she had lived to see them. They are not at all like her.*

Show that it is an ugly, crawling worm, with **six short legs** *in front of the body, and* **some thick fleshy feet behind.** *Lead the children to tell that the caterpillars which they see in the garden are exactly like this, except that some are a different colour, and some are covered with hairs.*

"Now I want you to pay attention to what I am going to tell you next. When the silk-worm has eaten enough and grown to its full size, it rolls itself up in a ball to go to sleep. But before it goes to sleep, it sends out from two small holes under its jaw a fine, yellow, sticky fluid, which at once **hardens into a silky thread.** With this thread the silk-worm covers its body up, so that it looks **like a ball or a small egg.**"

IV. The Cocoon

Show a cocoon. Tell that the silk-worm keeps on sending out more of this fine silk thread, and winding itself up in it, till it cannot make any more, and then it goes to sleep inside. We call this oval ball **a cocoon.**

"The little creature, if left to itself, would sleep snugly enough in the cocoon for about ten days, and then it would wake up, eat its way through the silky bed in which it had been lying, and come out. But how do you think it would look when it came out? I will tell you. It would **look just like its mother,** for it would be **a moth** with **four beautiful wings** just like hers."

Open one of the cocoons and show the chrysalis inside. The name may or may not be given at the teacher's discretion.

Explain that people who keep silk-worms want the silk for use. It would be spoilt if the moth were allowed to eat its way out of the cocoon through it. The cocoons are therefore thrown into boiling water, and this kills the moth before the time comes for it to leave them. The silk is then unwound from the cocoons on reels, to be made up into all sorts of things.

Try to make the children think of the immense number of silk-worms that must be at work to make all the silk which we use.

LEARNING TO BE USEFUL

Lesson XXVIII

LEARNING TO LAY THE DINNER-TABLE

I. Introduction

Commence with a little chat about home. Mother has many things to do. Boys and girls should try to learn, as soon as *they can, how to help her. There are many ways in which they can learn to make themselves very useful; and in time mother will feel that she would hardly know how to do without her little helpers.*

They might help her to lay the table for meals, to wash up the tea-things, to make the bed, and to do many things besides.

II. THE TABLE-CLOTH

"We are going to learn, now, how to lay the dinner-table. I think you will best learn all about it, if we do it here with dolly's dinner-table.

"Mary shall come to the front first, and set out the things on the table, and then I will call upon a few of the best children to come and do it afterwards. She will do only what we tell her; I shall want to see how far you yourselves can help her without me."

Have the toy table placed on the middle of the schoolroom table, or on something where it will be convenient for the children to see and reach. The various articles required should be stood in readiness on a side-table close at hand.

"Now, children, we are ready to begin. Tell Mary what she must do first?" "She must **lay the cloth.**"

"What kind of cloth is it?" "It is a **clean, white cloth.**"

"Is it always clean? Does it never get dirty?" "Yes; **it gets dirty** when we use it."

"What must be done with it then?" "It must be **washed, starched,** and **ironed.**"

"How does it look then?" "It looks **white, smooth, and shiny again.**"

Tell that mother always likes to keep her table-cloth clean and white as long as she can. Boys and girls can help her to do this by trying to be **careful at the table.** *If they are careless and untidy, and spill things on the cloth, it will very soon get dirty.* **A dirty table-cloth does not look nice.**

This is why, when dinner is over and the plates, dishes, and other things are cleared away, mother always **brushes the**

crumbs carefully off the cloth, *and* **folds it up** *neatly till it is wanted again. She always* **puts it away,** *too, in a drawer to keep it from the dust.*

"Now, Mary, you may get your cloth and lay it neatly on the table. When you lay the cloth at home for mother, you must see that it does not hang too far down on one side, or somebody's foot may catch it, and drag it off the table, with plates and dishes and all.

"Look at Mary's nice, smooth, white cloth. Do you know what it is made of? I will tell you. **It is made of linen.**"

III. THE KNIVES, FORKS, AND SPOONS

"Now, children, what must Mary do next?" "She must set out the **knives, forks,** and **spoons.**"

"Suppose she is going to lay the table for four persons—father, mother, and the two children. How many knives will she want?" "**Four.**"

"How many forks?" "**Four.**"

"Very well. Now tell her how to place them." "She must set a knife and a fork for each person—the **knife** must be on the **right,** ready for **the person's right hand,** the **fork** must be on the **left.**"

"Quite right. See if you can put them all in their proper places, Mary."

In going round to the different places at the table, it is quite likely the child will get into a muddle somewhere. This will give a good opportunity for the teacher to call upon one of the others to come and try to put her right.

"Now we have got the knives and forks placed at last. Look in the knife-tray, Mary, and you will find some **smaller forks** and some **spoons.** These **will be wanted for the pudding.** Lay them side by side **in front of each person's place.**

"Then, too, father will want the large knife and fork to cut up the meat. Do you know what we call them?" "We call them the **carving knife** and **fork.**"

"Yes, we do, because father **carves,** or **cuts up,** the meat with them.

"He will also want a **large table-spoon** to serve out **the gravy.**

"Put the carving knife and fork by the side of those he will use to eat his dinner, and put **the table-spoon next to the big knife,** so that he will have them both ready **at his right hand.**

"How should all these knives, forks, and spoons look?"

"They ought to look **clean, bright, and shining.**"

Show how to place table-spoons in pairs side by side at the corners of the table for serving vegetables.

If time permit, a word or two might be said about them—as to what they are made of, and how they are cleaned and kept bright.

IV. THINGS FOR DRINKING

"Who can think of the next thing to go on the table?"

"**Glasses** to drink with."

"Of course; and we must also have a **jug of nice, fresh, clear water** to drink."

Tell that children must be very careful in pouring the water into their glasses at dinner-time, or they will spill it on the nice clean cloth. That will make mother angry.

The glass should never be filled with water up to the top.

Tell, too, that it is wrong to drink very much water at our meals.

V. VEGETABLES, MEAT PLATES

"Is there anything else you can remember?" "**Mustard, pepper,** and **salt** will be wanted."

Have the cruet and salt-cellars put in their places. If there is no proper cruet, a mustard-pot and a pepper-box must do instead.

The table having been thus far arranged, have the toy chairs set round, and proceed to bring in the **vegetable dishes** *with the* **potatoes, cabbage,** *and* **other vegetables.** *Tell that* *the* **covers must be kept on** *the dishes to prevent the vegetables from getting cold.*

Next have the large meat dish (with something in it to represent the joint of meat) placed in front of the carver's chair; and, lastly, bring in the plates in a little pile, one for each person. The pile of plates must be set in front of the carver.

Tell that mother always likes to have the plates warm. That is why she does not put them on the table till the last.

Lesson XXIX

LEARNING TO WASH UP THE TEA-THINGS

I. INTRODUCTION

LEAD the children to think about tea-time at home. Boys and girls have come home from school—lessons are over for the day. They are looking forward to an hour or two's play before bedtime.

Tell that selfish, unkind children think only of their play—good, kind boys and girls always look out first to see what they can do to help mother—it makes their play so much sweeter afterwards.

Picture mother wanting to be very busy at something else. How pleased she is to have a handy child ready and willing to help her, by clearing away the tea-things and leaving everything neat and tidy before play is thought of.

II. DOLLY'S TEA-TABLE

"We are going to learn how to wash up the tea-things. But before we do that we must think about the things we have on the table at tea-time. You shall help me to lay Dolly's tea-table.

"Katie shall come and lay the table herself. I will give her the things as she wants them. Now, Katie, what will you want first?" "**The table-cloth.**"

Hand the child the cloth, neatly folded up, as it was put away when last used, and let her spread it on the toy table.

The tea-tray *will be the next thing wanted. Let it be placed on the table as she asks for it, and call upon the class to describe it. It is* **broad** *and* **flat,** *to rest steady on the table,* **to hold the cups and saucers** *and other things. Tell of its use in saving the tea* **from being spilled on the white cloth,** *when it is poured out of the tea-pot into the cups.*

The cups and saucers *will come next. Have them placed* **on the tray—one for each person,** *with* **spoons in the saucers.**

Lead the children to tell the use of the spoon for stirring the tea. Why do we stir it? It helps **to dissolve the sugar.**

"What else do we put on the tea-tray?" "**The sugar-basin, the cream-jug,** and **the slop-basin.**"

Have these things set out on Dolly's table, and let the children tell their uses.

"What do we eat with our tea?" "Bread-and-butter, sometimes cake, biscuits, jam, and other nice things."

"Where do we place these things?" "The bread and other things are placed on **bread plates** in the middle of the table, the butter in a **butter plate** with a glass cover, and the jam in a **small glass dish.**"

"What do we use to eat with?" "Each person has **a small plate** to hold the bread-and-butter or cake, and **a small knife** to cut it."

Tell that boys and girls should be careful to keep the crumbs on their plates.

III. How to clear away the Tea-Things

"When tea is over, the next thing is to clear away. We must begin by removing the bread, butter, cake, biscuits, sugar, and jam that are left. These things must be **put away carefully in the cupboard** where they are kept.

"The **crumbs should be shaken out** of the plates. They will do to feed the birds in the garden.

"**The cover** should be carefully placed **over the butter-plate** and **jam** to keep the dust from getting in.

"The next thing is to gather up the cups and saucers and spoons, the little plates and the knives, place them in the tray, and carry them into the kitchen to be washed."

Tell that this is where our little helpers must be very careful, or they will break some of the things. The best way is to stand two or three saucers one in the other, and **lay the cups in them on their sides.** *They will not be likely to roll off then. Have Dolly's tea-things collected up and put on the tray in the way described.*

"The next thing is to remove the cloth.

"Tell me what should be done before you remove the cloth." "The **crumbs should be carefully brushed off,** so that the cloth may be left quite clean."

Show how **the cloth** *itself should be* **neatly folded up,** *in the same way as it was folded, when it was taken out of the drawer before the meal.*

IV. The Washing-up

Describe the things required—**a large clean basin** *full of* **hot water,** *and* **a clean cloth.** *Why hot water? There is always some* **grease** *on the tea-things after the meal. The grease would not come off in cold water.*

Tell that the tea-things must be **placed in the water,** *and carefully washed. Care should be taken to see that* **no dirt** *is left* **round the handles of the cups and jugs.**

When they have been well washed, they should be taken out, one by one, first stood on the tray upside down to drain, and then **dried and polished** *with the cloth.*

The **knives** *must* **not be put into the hot water.** *The heat would crack the handles and spoil them. The spoons may be put into the water and washed with the other things.*

Last of all the **tray itself must be washed,** *dried, and polished.*

Lesson XXX

LEARNING TO MAKE THE BED

I. Going to Bed

Commence with a little chat about bed-time and going to bed. Father comes home tired from his work; mother has been busy all day at many things, and she is tired too; the children have been at their lessons all day, and since school-time they have been romping about. They are very tired when their bed-time comes. They cannot keep their eyes open. How nice it is to have a warm, snug bed to lie down on when they are tired. Mother washes them to make them clean and fresh after their play, and then away they go to bed.

They take off all the clothes they have been wearing during the day, and hang them up neatly in the bedroom ready for the next morning. Then they put on a nice, clean, fresh night-shirt, or night-dress instead. Think .what it would be if they had to sleep in the clothes they had been wearing all day. They would not rest comfortably; their dusty clothes would make the bed dirty; and the clothes themselves would be so crumpled and creased that they would not be fit to wear any more.

II. Getting up in the Morning

Continue the chat by leading the children to tell how they feel when they wake up the next morning. They went to bed **tired out,** *and so* **sleepy** *that they* **could not keep their eyes open.** *They wake up in the morning* **bright and fresh;** *all that* **tired, sleepy feeling is gone,** *and they are ready to work and play as much as ever they were.*

Tell that the first thing to be done when we get out of bed in the morning is to **throw open the windows** *to let in* **the fresh air.** *The* **bed-clothes** *should be* **thrown neatly over the foot of the bed,** *so as to leave the bed open to the* *air. This is one way in which even little boys and girls could help mother.*

III. MAKING THE BED

"If our bed is to be snug and comfortable to rest us well at night, it must be made properly every day. You should all learn how to make your beds. When you little girls get taller and stronger, you will be a great help to mother if you can do this work for her.

"Even boys ought to know how to make their bed. Many a boy, when he leaves home, has to make his own bed himself, or it would not be made at all."

Introduce Dolly's bed now, and tell the children that "we are going to make this pretty little bed, and that will show us how mother makes the beds at home."

Take the **bedstead** *first. Lead the children to describe it. It stands upon* **four legs** *to hold the bed and bedding* **up from the floor,** *and so keep them* **clean and dry.** *It has a* **head** *and a* **foot.** **Laths** *are stretched across, some from end to end, and others from side to side, to hold the bed. Some bedsteads are made of iron, some of brass, and some of wood.*

Take the bed itself next. Let the children feel it and tell how soft it is.

"What is the bed made of?" "It is made of **feathers.**"

"Look: the bed is really **a big bag** filled with feathers. It is the feathers that make it so nice and soft. The bag itself is made of **stout, close, linen cloth,** which we call **ticking.** It has to be thick and close, or the feathers would come out, and the dust and dirt would get in."

Tell that some beds are made of **wool** *instead of feathers.*

Show some wool flocks.

We call these **flock-beds.** *They are not so soft as a feather bed.*

Show the **bolster** *and* **pillows** *next, and proceed to deal with them in the same way.*

This done, turn once more to the bed. Place it on the bedstead itself, and show that this would not do. The soft bed

would sink between the laths *of the bedstead, and that would make it very uncomfortable to lie upon.*

This is why we use a **mattress.** *Show the toy mattress. Let the children handle it, and tell that it is* **stiff and strong,** *and not soft like the bed. It* **lies quite flat** *on the bedstead; and makes a nice, flat, even place, for the bed to lie upon.*

Tell that mattresses are made of **stout, strong linen,** *and stuffed thick either with* **straw, wool,** *or* **horse hair.**

"Now suppose we set to work and make Dolly's bed. Norah shall come here and do it first.

"Before we begin, tell me once more how we should leave the bed when we get up in the morning." "The bed-clothes should be thrown over the foot of the bed, and the bedroom window should be opened wide."

Tell that mother makes it one of her first duties in the morning **to air the bed.** *Do you know what I mean by this? She takes off all the bed-clothes, and hangs them over the backs of the chairs, and then she shakes the bed up well, and leaves it for a while. When she thinks it has been* **properly aired,** *she makes it up ready for night again. This is what Norah is going to do now.*

"We must first see that the bed itself is **smoothed down** and made to lie flat and even again after its shaking; and then we will lay the bed-clothes on it.

"Take this **blanket** to begin with, Norah, and spread it on the bed. That will do. Now spread the **sheet over the blanket.** See that the sheet is made to lie smooth and even.

"We lie upon this sheet, and that is why we call it **the under sheet.** The blanket is put under it to make the part we lie upon **warm and snug.**

"What shall we want now?" "The **bolster** and the **pillows.**"

"Quite right. You must lay the bolster **straight across the head** of the bed, and place the pillows on it.

"Now you see the bed is made so that we could lie on it comfortably. All we have to do is to cover it up.

"What shall we put on first?" "**The sheet.**"

"Very well. Lay the sheet on neatly, Norah. We call it the **top sheet.** Of course you can tell me why."

Proceed next to have the **blankets laid on the sheet;** *and show how both* **are to be tucked in,** *round the sides and foot of the bed.*

"What do we call the outside cover of the bed?" "**The counterpane.**"

Produce Dolly's counterpane. Show how to lay it on the bed. It must be laid smoothly and evenly all round. The top sheet and blankets **must be folded down over it,** *so that the white pillows may be seen. Dolly's bed is made.*

OBJECTS AND OTHER ILLUSTRATIONS REQUIRED

STAGE III

Lesson II

The foot-rule; a few pieces of ribbon of different widths; a yard or two of common wall-paper, or some strips of brown paper pasted together.

Lesson III

A yard of string; some drawing-pins; a sheet of drawing-paper; a flat ruler.

Lesson IV

An orange and a sharp knife; the kindergarten balls; one or two large marbles; a large india-rubber ball.

Lesson V

A round ruler; a new lead pencil; a piece of broom-handle; a round tin canister; a sheet of drawing-paper.

Lesson VI

A sheet of drawing-paper with nine small circles marked on it, as described in the lesson; some drawing-pins; two or three small saucers; a few brushes; a basin of water; pans or cakes of the colours mentioned ; coloured paper strips and wools for exercising the children in matching and selecting the colours.

LESSON VII

The same as for the previous lesson.

LESSON VIII

A few peas and beans ; some pea and bean pods ; some well-soaked beans ; three flower-pots containing peas or beans in different stages of growth ; some pips from apples, pears, oranges, and lemons ; some plum and cherry stones ; and any other seeds available.

LESSON IX

A plant in a flower-pot ; a collection of simple leaves, such as are mentioned in the lesson ; a scrap-book of pressed leaves.

LESSON X

A few simple annuals in pots ; a scarlet-runner growing in a pot ; some tall grass ; a picture of a tree ; a piece of the stem of a tree.

LESSON XI

The articles used in the last lesson ; a piece of rough cork ; one or two bottle corks ; some specimens of different woods ; a bottle ; a basin of water.

LESSON XII

A sheet of glass about a foot square ; a candle and candlestick ; two small basins (one glass, the other earthenware) ; one of the red kindergarten balls.

LESSON XIII

A basin of water ; some sand or saw-dust ; a couple of tumblers ; a large coloured marble ; a glass of milk.

LESSON XIV

A jug of water ; a basin, a bottle, a dish, and a tumbler ; a ball, a cube of wood, a lead pencil, a piece of a brick or stone ; a piece of ice ; a piece of wax and a large iron spoon ; the spirit-lamp.

LESSON XV

Some pieces of salt and loaf sugar ; a hammer ; a nutmeg grater ; some saucers ; two or three tumblers ; the spoon and spirit-lamp used in the last lesson ; the evaporating dish.

LESSON XIX

A sheep's heart.

LESSON XX

A lemon and a sharp knife.

LESSON XXI

A bladder ; a black-board sketch of the wind-pipe ; a sheep's lights.

LESSON XXII

A black-board sketch of the bones of the hand ; another of the hand-wing of the bird ; one or two shank bones of a rabbit, and if possible the skeleton of a bird ; a live pigeon, and a small mammal about the same size, *e.g.* a guinea-pig, a kitten, or a rabbit, if they can be obtained.

LESSON XXIII

The leg and foot of a fowl and a duck. Picture of a duck swimming in the water.

LESSON XXIV

A basket (or bag) of feathers; a bird of some kind (either a live one in a cage, or a stuffed specimen); the head of a fowl to show the beak.

LESSON XXV

A picture of the cow and calf; a hen's egg, and a small collection of other eggs, including those of the goose, duck, pigeon, and as many of the smaller birds as possible; a bird's nest; a picture of hen and chickens; a picture of birds in a nest.

LESSON XXVI

A picture of the bat; the wing of some bird.

LESSON XXVII

Some specimens of butterflies pinned on a sheet of cardboard; a similar card containing specimens of some of the commonest insects.

LESSON XXVIII

The card-board clock-face.

LESSON XXIX

Two card-board clock-faces as described in the lesson.

LESSON XXX

A card-board clock-face with two hands, and with the minutes marked on it.

STAGE IV

Lesson I

The teacher will require the "Box of Forms" (or failing it card-board and scissors); some narrow strips of card-board, a box of small drawing-pins; and slates and pencils for the children.

Lesson II

The "Box of Forms"; a sheet of drawing-paper; a pair of scissors.

Lesson III

The "Box of Forms," or (in the absence of these) figures cut in paper or card-board; a cube of wood, and a square prism having the same base; a triangular prism; some drawing-paper and a pair of scissors.

N.B.—Should there be any difficulty in getting suitable solid figures in wood, the exact thing may be easily cut out in soap.

Lesson IV

Provide the solid figures mentioned in the lesson. In the absence of the proper models, a bar of soap and a sharp knife, as stated above, will give excellent substitutes. Provide also some drawing-paper on which to trace the shape of the base and sides of the figures.

Lesson V

The sheet of paper as used in Stage III., Lesson VI.; some drawing-pins; the pans or cakes of colours; a few small saucers and brushes; the "box of colours"; ribbons, skeins of silk, coloured wools, and paper strips.

LESSON VI

The articles used in the last lesson.

LESSON VII

The articles used in the last lesson.

LESSON VIII

Provide a piece of bread, some flour, and a few grains of wheat; some corn-grass growing in a flower-pot; some straws; a bunch of flowering grass ; ears of wheat, barley, and oats; a cobb of maize, and a few grains of the corn; a handful of rice. Show, if possible, a picture of the harvest-field.

LESSON IX

Provide, as far as possible, specimens of all the common vegetables, *e.g.* potatoes, carrots, turnips, parsnips, onions, cabbage, celery, peas, and beans. A black-board sketch of the growing plant should also be shown, or, if that is not possible, there should be a picture. There should also be a dish of boiled potatoes.

LESSON X

One or two specimens of ripe fruit; a handful of raisins; a picture of the sugar-cane, and another, if possible, of the sugar-harvest; specimens of raw and loaf-sugar.

LESSON XI

Some dry tea; a kettle of boiling water; a cup and saucer; a picture of the growing tea-plants; some ground coffee, and a few coffee berries; a picture of a coffee-tree; some soluble cocoa, and specimens of cocoa nibs; the pod with the cocoa beans; a picture of the cocoa-tree.

LESSON XII

A piece of calico; a picture of the cotton plant; a cotton pod showing the cotton-wool; a picture of the flax-plant; some linseed, and linseed-oil; a specimen of linen.

LESSON XIII

A strip of india-rubber and a strip of wash-leather.

LESSON XIV

A large dry sponge; a basin of water; some small sponges for distribution round the class; a saucer; a large pebble stone.

LESSON XV

Specimens of clay, chalk, limestone, coal, slate, common table-salt, rock-salt, stone, gravel, sand, and the common metals —iron, lead, copper, tin, and zinc, with ores of as many as can be obtained.

LESSON XVI

A lump of moist clay; some sheep's wool; a piece of dry, hard clay, which was squeezed in the hand when moist and retains the shape then given to it; a large glass jar filled with layers of different mineral substances—the lowest should be clay, and above that should come coal, then other layers might follow such as chalk, sand, gravel, clay. This would give the children a good idea of the way these things lie in the earth.

LESSON XVII

The gum bottle and brush; one or two saucers; a jug of water; some paste; a postage stamp, and an envelope; the glue-pot and some glue.

LESSON XVIII

A piece of tape; a sheep's brain.

Lesson XX

A piece of wash-leather ; some mercury.

Lesson XXI

Picture of a cow.

Lesson XXII

Picture of sheep and lambs in the field ; picture of sheep-shearing ; specimen of sheep's wool ; a piece of wash-leather.

Lesson XXIII

Picture of the horse ; some horse-hair ; a horse-shoe, and nails.

Lesson XXIV

Pictures of the dogs mentioned in the lesson.

Lesson XXV

Pictures of ducks, geese, and fowls ; specimen legs and heads of the duck and the fowl.

Lesson XXVI

The two cards—one with specimens of butterflies, the other with specimens of various insects—as used in Stage III., Lesson XXVII. ; a similar card containing specimens of bees. (Failing the pinned specimens, pictures must be used.) A picture showing the bee entering a flower ; some honey, and a piece of the honey-comb ; a large, well-developed flower of some kind, with ripened anthers ; a picture of a bee-hive.

Lesson XXVII

Specimen of silk worms, moths, cocoons, and eggs, or failing the actual specimens, pictures of the same ; a few specimens of silk ; one or two garden caterpillars ; some mulberry leaves.

LESSON XXVIII

The toy table and table-cloth ; four chairs ; knives, forks, and spoons ; glasses, cruet, and salt-cellars ; the toy dinner service.

LESSON XXIX

The table, table-cloth, and chairs as in last lesson ; tea-tray and toy tea-service ; tea-spoons ; crumb brush ; a large basin of hot water ; a clean linen cloth for washing up.

LESSON XXX

The toy bedstead and bedding ; some feathers ; some wool flocks.

THE END

Printed by R. & R. CLARK, LIMITED, *Edinburgh.*

By the same Author.

In Three Volumes. Vol. I., Stand. I. and II., 2s. 6d.
Vol. II., Stand. III. and IV., 3s. Vol. III., Stand. V. and VI., 3s. 6d.

OBJECT LESSONS
IN
ELEMENTARY SCIENCE

FOLLOWING THE SCHEME ISSUED BY THE
LONDON SCHOOL BOARD

CONTENTS

Vol. I.

Standard I.

Lesson—1. Water; 2. Liquids and Solids; 3. Hard and Soft Bodies; 4. Porous Bodies; 5. Plastic Bodies—A Piece of Clay; 6. Clay—Its Uses; 7. Plastic Bodies—A Piece of Putty; 8. Putty; 9. Gutta Percha; 10, 11. Soluble Substances; 12. Sugar; 13. Burning; 14. Coal—Its Properties; 15. Its Uses; 16. The Mine; 17. The Mine and its Workers; 18. Fire-damp in the Mine; 19. Flexible and Elastic Substances; 20. India-rubber. Lessons from Animals: 21. The Cat; 22. The Cat's Big Cousins; 23. The Dog; 24. Dogs; 25. The Sheep; 26. The Pig. Lessons from Plants: 27. Parts of a Plant; 28. The Root; 29. The Stem; 30. Stems; 31, 32. Leaves; 33. Flowers.

Standard II.

Lesson—1. Porous Bodies; 2. Sponge; 3. Filters; 4. Soluble Substances; 5. Soluble and Insoluble; 6. Adhesive Substances; 7. Fusible Substances; 8. Some more about Metals; 9. Iron; 10. Cast Iron; 11. Wrought Iron; 12. Steel; 13. Copper; 14. Lead; 15. Tin; 16. Zinc; 17. Silver; 18. Gold. Lessons from Plants: 19, 20. Starch; 21. Corn; 22. Rice; 23. Maize. Lessons from Animals: 24. The Cow; 25. Milk, Butter, and Cheese; 26. The Horse; 27, 28. The Rabbit; 29. The Monkey; 30. The Mole. Objects and other Illustrations required.

VOL. II.

STANDARD III.

LESSONS FROM PHYSICS—LIQUIDS: 1. Water—A Liquid; 2. Water as a Solvent; 3, 4. Water in other Forms; 5. Solid Water; 6. Mercury—Its Properties; 7. Mercury; 8, 9. Alcohol. GASES: 10, 11. Air; 12. Gases; 13, 14. Coal-Gas; 15. Other Products of Coal; 16. Paraffin Oil; 17, 18. Carbonic Acid Gas. LESSONS FROM BOTANY: 19. Parts of a Plant; 20. The Work of the Organs; 21. Parts of a Flower; 22. The Flower and its Work; 23. Seeds and Seedlings—Dicotyledons; 24. How Seeds grow; 25. Seeds and Seedlings—Monocotyledons; 26. The Bark; 27. Kinds of Bass; 28. Flax; 29. Linen-Making. LESSONS FROM ZOOLOGY: 30. Birds and their Covering; 31. A Feather; 32. Birds; 33. Classes of Birds; 34. Birds—Legs and Feet; 35. Reptiles; 36. Kinds of Snakes; 37, 38. The Frog; 39. The Frog—Its Life-History; 40, 41. A Fish; 42, 43. An Insect; 44. A Spider; 45. The Spider's Web.

STANDARD IV.

LESSONS FROM MECHANICS: 1. Matter; 2. Capillary Attraction; 3. Properties of Solids; 4. Weight; 5. Liquids; 6, 7, Pressure of Liquids; 8. Buoyancy of Liquids; 9. Pressure of the Atmosphere; 10. Weight of the Atmosphere; 11. The Barometer; 12. The Syringe; 13. The Suction-Pump; 14. Other Pumps; 15. The Air-Pump. LESSONS ON HEAT: 16. How Heat affects different Substances; 17. Expansion and Contraction; 18. The Thermometer; 19. How to make a Thermometer; 20. Thermometers; 21. Ice. LESSONS FROM BOTANY: 22. The Woody Stems of Plants; 23. The Wood of the Exogenous Stem; 24. The Oak and the Fir; 25. Timber; 26. Timber—Its Uses.

BOYS OR GIRLS

LESSON—27. The Atmosphere—what it is; 28. More about the Atmosphere; 29. Water—Its Composition. General Structure of the Human Body; 30. The Bony Skeleton; 31. The Joints; 32. Muscles, Nerves, and Skin; 33. Circulation of *the* Blood; 34. Digestion; 35. Respiration. LESSONS FROM

ZOOLOGY: 36. The Animal Kingdom; 37. Nature of the Backbone; 38. Vertebrates; 39. The Invertebrates; 40. Classification of Invertebrates; 41, 42. Mammals; 43, 44. Birds; 45. Reptiles, Batrachia, Fishes; 46. Structure and Habits compared; 47. The Covering of Animals; 48. The Mouths of Animals; 49. The Internal Organs. Objects and other Illustrations required.

VOL. III.

STANDARD V.

LESSONS FROM MECHANICS (Boys only): 1. Matter; 2. General Properties of Matter; 3. Measurement as practised by the Mechanic. LESSONS FROM HEAT: 4. Distribution of Heat—Conduction; 5. Convection; 6. Boiling; 7. Steam and the Steam-Engine; 8. Distribution of Heat—Radiation; 9. How Heat affects the Absorption of Vapour by the Air; 10. Heat, the Cause of Motion in the Air; 11. Winds and Currents; 12. Specific Heat. DOMESTIC ECONOMY — FOOD (Girls only); 13. Why we eat; 14. Food—why we eat; 15. Animal Food; 16. Vegetable Foods; 17. Vegetable Foods; 18. A Mixed Diet; 19. Clothing; 20. Washing. LESSONS FROM BIOLOGY (Boys and Girls): 21. Economic Products of Plants—A Recapitulation; 22. Tea; 23. Coffee; 24. Cocoa; 25. Vegetable Oils; 26, 27. Vegetable Secretions—Camphor and Gums; 28. Cotton; 29. Bones and Joints; 30. The Limbs of Animals—Locomotion; 31. Teeth of Mammals; 32. The Skin; 33. The Coverings of Animals; 34. Wool.

STANDARD VI.

LESSONS FROM MECHANICS (Boys only): 1. Machines; 2, 3, 4. The Lever; 5. The Pulley; 6. The Wheel and Axle: 7. The Inclined Plane; 8. The Wedge; 9. The Screw; 10. Water as a Machine. THE DWELLING (Girls only): 11. Warming; 12. Cleaning; 13. Ventilation. LESSONS FROM CHEMISTRY (Boys and Girls): 14. Elements and Compounds; 15. Chemical Combination; 16. Combustion: 17. The Air a Mixture of Gases; 18. Chlorine; 19. Carbon; 20. Sulphur; 21. Phosphorus; 22. Acids; 23. Bases, Alkalies, Salts. LESSONS FROM PHYSIOLOGY: 24. The Blood and its Work; 25. The Circulation of the Blood; 26. The Heart; 27. The Great Blood-vessels of the

Heart; 28. Oxidation; 29. Respiration—The Lungs; 30. The Work of Breathing; 31. Waste and Repair; 32. Digestion; 33. Absorption. PLANTS USEFUL FOR FOOD: 34. Bread-Food—The Cereals; 35. Other Bread-Stuffs; 36. Other useful Vegetables; 37. Fruits and Nuts; 38. Spices; 39. Sugar; 40. Beverages—Infused Drinks; 41. Fermented Drinks; 42. Plant-fibres for Spun and Woven Goods. ECONOMIC PRODUCTS OF ANIMALS: 43. Animals useful for Food; 44. Wool of the Sheep; 45. Other Wool; 46. Leather—Hides; 47. Skins; 48. Bones; 49. Ivory; 50. Horns; 51. Tallow and Offal of Animals: 52. Fur; 53. The Whale and its Products; 54. Silk. Objects and other Illustrations required.

OPINIONS OF THE PRESS

SCHOOL BOARD CHRONICLE.—"Essentially a work for the service of teachers in public elementary schools, working under Code requirements and conditions, these three volumes of *Object Lessons in Elementary Science* could not have been issued under any recommendation more pointed and effective than that which is given in the brief prefatory explanation of the circumstances under which the lessons were prepared and of the immediate cause of their being published. . . . Next to the practical knowledge and experience upon which they are based, the strong point of the lessons is their absolute thoroughness. Nothing is omitted that can be expressed in the written word. What to do and what to say are suggested concurrently, with clearness and precision, not with the object of binding the experienced teacher to the smaller details as with that of enabling him to rely very largely on the book, as affording sufficient guidance even for pupil-teachers, while leaving his own freedom unimpaired. Take a few of the first sentences from the first lesson on Matter, with which the third book opens:—

'1. EXISTENCE OF MATTER

Show a brick, or any common object. Make the class describe it, as to its size, colour, and shape.

How do we learn this much about the brick? Our eyes tell *us;* that is, we learn **through the sense of sight.**

Hand the object round, and make the class tell that it is hard and rough.

This we learn **through the sense of touch.**

Take two bottles, one containing paraffin, the other water.

Here we have two things which neither our eyes nor our sense of touch will help us to distinguish.

What would be a good way to find out? Smell the two bottles. Quite right. Here we rely upon another sense, **the sense of smell,** to tell us how to distinguish two bodies.

Here are two pieces of white substance—one is sugar, the other salt. . . . I soon learn to distinguish them; and this time through another sense—**the sense of taste.**

Everything around us which appeals to us in this way, through one or more of our senses, we call **matter.**

By the name **matter,** then, we mean **every substance that exists; every substance about which we may learn through the senses.**

The air around us is matter. We know that it has an existence, for although we can neither see, smell, nor taste it, we can hear it when it is in motion, and we can feel it as it rushes through our mouth and nostrils in the act of breathing.'

This is very clear and very complete, and in these qualities is a fair example of the whole."

SCHOOLMASTER.—"In the nick of time Mr. Murché has launched this most able series of *Object Lessons in Elementary Science.* To those teachers who were in doubt as to a scheme of lessons for their schools in order to satisfy the demands of the Code for next year, they will not only form a guide, but prove a rich storehouse from which to draw. . . . As a 'teacher's aid' the book will, we have little doubt, soon form part of every teacher's library, not only because they contain such a wealth of useful knowledge, but on account of the scientific treatment of the lessons from an educational standpoint."

JOURNAL OF EDUCATION.—"Written by an experienced headmaster, the lessons are in every way excellent. Each lesson is divided in three or more parts and is written out in full. The instructions to the teachers are printed in italics, while the salient points are indicated by a change of type. At the end of each book are lists of the objects required for each lesson, and here and there are some clear outline sketches to be drawn by the teacher on the black-board. We cannot too highly recommend these books. They are admirable, and display great thought and care."

GUARDIAN.—"We can honestly recommend these books, particularly for pupil-teachers, who will find therein much teachable material ready to hand, arranged in such a way as to show them also how to teach it."

BOARD TEACHER.—"Worked out with much care and the application of much practical knowledge and teaching ability, these works form a manual for teachers of the highest value."

NATURE.—"To our minds, this method of teaching elementary science is admirable. It must not be supposed, however, that Mr. Murché only deals with physical conditions. His excellent little volumes are also concerned with the chemistry of common things, with the mechanics of every-day life, with zoology, botany, and physiology, and with various arts and manufactures. . . . We know no better work for teaching elementary science to young children."

POLYTECHNIC MAGAZINE.—"Each volume is well illustrated, and all the subjects dealt with are explained carefully and in a manner such as would make the lessons, especially when accompanied as the author wishes, with specimens of the objects, most interesting and entertaining to the students."

EDUCATIONAL NEWS.—"The London School Board recently issued a full and thorough scheme of object teaching in elementary science for the guidance of their staff. The headmaster of Boundary Lane Board School, Camberwell—whose lesson-books on botany and physiology had won repute—at once proceeded to provide for each section of the school under his charge, notes of lessons following the lines indicated. From these, the classes have been taught with a success so remarkable that the vice-president of the Council of Education—Mr. A. H. D. Acland—at the suggestion of H.M. Inspector, came to see the results, and recommended the publishing of the notes. They appear in three volumes—though each is complete in itself in matter and method, and, taken together, they form a condensed library of lessons in elementary science, which only want a copious index for inter-reference to be perfect for their purpose.

Vol. I., for Standards I. and II., comprises lessons from common objects, from plants, and from animals. Vol. II., for Standards III. and IV., supplies, in the one case, lessons from physics, botany, and physiology, and in the other, on mechanics, heat, botany, physiology, and zoology. Vol. III. becomes more specific and provides in Standard V. lessons on mechanics for boys only, and on heat and biology for both, and in Standard VI. more advanced teaching for boys in mechanics, for girls in domestic economy, and for both in chemistry and biology. There are in all 245 lessons in the three volumes. The instructions given to teachers in regard to what is to be shown, examined, told, questioned, and pictured at each lesson are explicit and definite, and a list of objects and illustrations required for each lesson is plainly and carefully given. In usable, intelligent, and easily studied form, the teacher has prepared to his hand a concise practical cyclopædia of science teaching, carefully arranged and trustworthy as to statement and fact, which he may use, condense, or amplify as he pleases; but the nature of which he can see clearly, and the results of which he can calculate with certainty upon effecting. The book forms a manual of great value, and must greatly aid all who are anxious to train their pupils to know and rejoice in the world of wonders to the perception of which science sharpens the sight of eye and mind. We commend it most heartily."

SPALDING FREE PRESS.—"The compiler has both set about and completed his task with conspicuous ability. It is scarcely too much to say, taking the three volumes, that Mr. Murché has dealt with elementary science in all its phases, and anything more helpful to the practical teacher in a well-appointed school, it would be difficult to conceive."

CANON DANIEL, Principal of St. John's Training College, Battersea, writes: "The subjects are well selected and well graduated, and the method of treatment is highly scientific. The pupils are brought into direct contact with the things themselves of which the lessons treat, and the writer contents himself with directing their observation and reasoning. The large use made of comparison throughout the lessons is in accord with the most advanced pedagogy of the day."

An ORGANIZING SECRETARY writes: "I have carefully examined your *Object Lessons in Elementary Science.* I have been seeking for a suitable book of Object Lessons to place in the hands of my assistants and pupil-teachers to enable them to prepare lessons for their classes. These books are admirably adapted for this purpose. The subject-matter is well chosen, its arrangement is excellent, and the methods to be employed in teaching it are clearly and ably indicated. Every pupil-teacher should have a copy. I shall strongly recommend the books."

A HEADMASTER writes: "Many a heavily weighted teacher in the smaller schools who has been, and is now, looking forward to the best ways and means of fulfilling the recent Departmental regulations respecting 'Object Lessons' in the lower standards, will be relieved and encouraged on studying the well ordered and skilfully arranged matter, and the apt and familiar illustrations which are introduced by the accomplished author in this very practical and useful series."

A HEADMASTER writes: "I have gone very carefully through them, and I think they will prove of the greatest service to teachers. The present series belongs to that small class of books in which thoroughly reliable scientific information is presented in the most suitable form."

ONE OF H.M. INSPECTORS writes: "The Lessons, I think, are admirably drawn up, and pregnant with hints which cannot fail to be appreciated by practical teachers. Such a book will not only be useful in large, well-staffed Board Schools, but in view of the new requirements as to Object Lessons, and to the fact that many teachers are considering Elementary Science as a Class Subject, it will be invaluable to country teachers in its suggestiveness."

ANOTHER INSPECTOR writes: "I am reading them with very great interest and pleasure, and think you have rendered a great service to teachers everywhere by publishing these valuable lessons."

Also by the same Author.

SCIENCE READERS

FOR THE USE OF ELEMENTARY SCHOOLS

IN SIX BOOKS

Book I.	**1s. 0d.**	**Book IV.**	**1s. 4d.**
„ II.	**1s. 0d.**	**„ V.**	**1s. 6d.**
„ III.	**1s. 4d.**	**„ VI.**	**1s. 6d.**

N.B.—*It should be carefully observed that some of the subjects do not lend themselves to pictorial illustration so readily as others. It is on this account, and to prevent one section of the book from becoming less attractive to the child than another, that the subjects have been intermingled in those reading-lessons. A book, with the bulk of its illustrations in one or two sections, would fail to attract the young reader. The teacher, who uses these readers to supplement his oral lessons, will find each subject, and every part of each subject, in its natural order, although the readings are interspersed one with another. This remark applies equally to each book of the series.*

CONTENTS

Book I.

Lesson—1. Water; 2. Water—A Liquid; 3. Solids; 4. Liquids and Solids; 5. The Cat; 6. More about the Cat; 7. Hard and Soft Bodies; 8. Porous Bodies; 9. The Dog; 10. Dogs; 11. A Piece of Clay; 12, 13. Clay—Its Uses; 14. The Cat's Big Cousins—The Lion; 15. The Cat's Big Cousins—The Tiger; 16. Wolves and Foxes; 17. A Piece of Putty; 18. Putty; 19. Gutta-Percha; 20. A Piece of Salt; 21. The Sheep; 22. Salt; 23. The Pig; 24. Rock Salt—Table Salt; 25. A Plant; 26. Sugar; 27. The Root of a Plant; 28. Loaf Sugar; 29. The Root and its Work; 30. About Burning; 31. The Stems of Plants; 32, 33. Coal; 34. Leaves; 35. Coal—The Mine; 36. The Mine and the Miners; 37. More about Leaves; 38. More about the Mine; 39. Flowers; 40. What we mean by Elastic.

Book II.

Lesson—1. Porous Bodies; 2. Sponge—and its Uses; 3. The Sponge; 4. Filters; 5. The Poor Man's Filter; 6. Soluble; 7. Soluble Substances; 8. Starch; 9. What Starch is; 10. Starch for Food; 11. Soluble and Insoluble; 12. Soap; 13. Corn; 14. Kinds of Corn; 15. Adhesive; 16. Cements; 17. Wheat and Rice; 18. Fusible; 19. Maize; 20. About Metals; 21. Some more about Metals; 22. Iron Ore; 23. Iron; 24. The Cow; 25. Cast Iron; 26. Milk, Butter, Cheese; 27. Wrought Iron; 28. The Horse; 29. Steel; 30. The Rabbit; 31. Copper; 32. The Rabbit at Home; 33. Lead; 34. The Monkey; 35. Tin; 36. Three Classes of Monkeys; 37. Zinc; 38. The Mole; 39. Silver; 40. Gold; Summary of Lessons.

Book III.

Lesson—1. Water—Its Properties; 2. Some of the Uses of Water; 3. Birds and their Covering; 4. A Feather; 5. The Uses of Feathers; 6. Water as a Solvent; 7. Further Uses of Water; 8. Birds; 9. Water in other Forms; 10. Vapour in the Air; 11. Birds and their Beaks; 12. More about Beaks; 13. Vapour—What becomes of it; 14. Clouds, Rain, Dew; 15. Birds—Their Legs and Feet; 16. Birds—More about Legs and Feet; 17. Solid Water; 18. Ice, Hail, and Snow; 19. A Snake; 20. How the Snake Feeds; 21. Mercury; 22. The Poisonous Snakes; 23. The Non-Poisonous Snakes; 24. Mercury—Its Preparation and Uses; 25. The Frog; 26. Air; 27. More about the Frog; 28. More about the Air; 29. The Frog and the Toad compared; 30. Gases; 31. The Frog—Its Life History; 32. Coal-Gas; 33. A Fish; 34. More about Coal-Gas; 35. More about the Fish; 36. Balloons; 37. How the Fish Moves; 38. Tar; 39. The Fish and its Food; 40. Paraffin Oil; 41. An Insect; 42. Carbonic Acid Gas; 43. More about Insects; 44. More about Carbonic Acid Gas; 45. Life History of an Insect; 46. Parts of a Plant; 47. The Spider; 48. The Vital Organs of the Plant; 49. The Spider's Web; 50. Parts of a Flower; 51. More about the Flowers; 52. The Flower and its Work; 53. Seeds; 54. Seedlings; 55. The Seed-Leaves; 56. The Single Seed-Leaf; 57. The Bark; 58. Kinds of Bass; 59. Flax; 60. Linen-Making; Summary of Lessons.

Book IV.

Lesson—1. Cohesion; 2. Solids, Liquids, Gases; 3. Our Bodies; 4. The Woody Stems of Plants; 5. Capillary Attraction; 6. More about the Skeleton; 7. The Oak Stem; 8. Joints; 9. Properties of Bodies; 10. How the Bones Move; 11. The Oak and the Fir (a Comparison); 12. Gravity; 13. Vertebrates and Invertebrates; 14. Timber; 15. The Nerves; 16. Timber—Its Shrinkage and Preservation; 17. Cohesion in Liquids; 18. Circulation of the Blood; 19. Timber—Its Uses; 20. The Vertebrates; 21. More about Timber; 22. Further Properties of Liquids; 23. The Invertebrates; 24. Pressure of Liquids; 25. Classification of Invertebrates; 26. More about the Pressure of Liquids; 27. Digestion; 28. Buoyancy of Liquids; 29. Mammals; 30. Floating Bodies; 31. Air has Weight; 32. More about the Mammals; 33. Pressure of the Atmosphere; 34. The Atmosphere — What it is; 35. More about the Mammals; 36. Weight of the Atmosphere; 37. Birds; 38. More about the Atmosphere; 39. Respiration; 40. More about Birds; 41. How Heat affects Bodies; 42. The Tube of Mercury; 43. Reptiles; 44. Water; 45. The Barometer; 46. Expansion and Contraction; 47. Fishes; 48. The Syringe; 49. The Thermometer; 50. Structure and Habits compared; 51. The Suction-Pump; 52. How to make a Thermometer; 53. The Skin and its covering; 54. The Lifting-Pump; 55. Thermometers; 56. The Mouths of Animals; 57. The Force-Pump; 58. Ice; 59. The Internal Organs; 60. The Air-Pump.

Book V.

Lesson—1. Matter; 2. Man and Brute; 3. Conduction of Heat; 4. Tea; 5. Solids, Liquids, and Gases; 6. Bones and Joints; 7. Conductors and Non-conductors; 8. Tea—Its Cultivation and Preparation; 9. Food—Why we eat; 10. General Properties of Matter; 11. Locomotion in Mammals; 12. Boiling; 13. Coffee; 14. Constituents of the Body; 15. General Properties of Matter; 16. Limbs and Locomotion; 17. Convection of Heat; 18. Cocoa; 19. Kinds of Food; 20. Measurement of Matter; 21. The Skin; 22. The Boiling Point of Liquids; 23. Vegetable Oils; 24. Animal Food; 25. Measurement as practised by the Mechanic; 26. The Skin—Cleanliness; 27.

Distillation; 28. Other Vegetable Oils; 29. Animal Food—Milk, Butter, Cheese, Eggs; 30. Steam; 31. Covering of Mammals; 32. Vegetable Secretion—Sugar; 33. The Steam-Engine; 34. Vegetable Foods; 35. Vegetable Secretions—India Rubber and Gutta Percha; 36. Radiation of Heat; 37. More about the Farinaceous Foods; 38. Vegetable Secretions—Camphor and Gums; 39. Teeth; 40. Radiators and Absorbers; 41. Leguminous Foods; 42. How Heat affects the Absorption of Vapour by the Air; 43. Resin and Turpentine; 44. Teeth of Mammals; 45. Formation of Dew and Hoar Frost; 46. Fresh Vegetables and Fruit; 47. Tar and Pitch; 48. Heat the cause of Motion in the Air; 49. Clothing; 50. Ventilation; 51. Winds; 52. Sources of Clothing; 53. Currents; 54. Cotton; 55. Coverings of Mammals—Furs; 56. Specific Heat; 57. The Cotton Manufacture; 58. The Effects of differences in Specific Heat; 59. Coverings of Mammals—Wool; 60. The Woollen Manufacture.

BOOK VI.

LESSON—1. The Forces of Nature; 2. Elements and Compounds; 3. The Blood and its Work; 4. Plants useful for food—(Bread Food—The Cereals); 5. Machines; 6. Nature of an Element; 7. The Blood-Vessels of the Body; 8. Plants useful for Food—(Other Breadstuffs); 9. The Lever; 10. Chemical Combination; 11. The Heart; 12. Plants useful for Food—(Other useful Vegetables); 13. Animals useful for Food; 14. First Order of Levers; 15. Combustion; 16. Oxidation; 17. Plants useful for Food—(Fruits and Nuts); 18. Animal Food—(Sources of Supply); 19. Second Order of Levers; 20. Water—a Compound of Oxygen and Hydrogen; 21. The Lungs; 22. Wool; 23. Third Order of Levers; 24. Air—a Mixture of Gases; 25. Varieties of Wool; 26. The Work of Breathing; 27. The Pulley; 28. Chlorine; 29. The Woollen Manufacture; 30. The Movable Pulley; 31. Plants Useful for Food—Spices; 32. Carbon; 33. Leather—Hides; 34. The Wheel and Axle; 35. Waste and Repair; 36. Leather—Skins; 37. Sulphur; 38. Plants useful for Food—Sugar; 39. The Inclined Plane; 40. Bones and their Uses; 41. Digestion; 42. Phosphorus; 43. Ivory; 44. The Wedge; 45. Beverages—Infused Drinks; 46. The Screw; 47. Horns; 48. Absorption; 49. Beverages

—Fermented Drinks; 50. Water as a Machine; 51. Tallow and Offal of Animals; 52. Acids; 53. Plant-fibres for Spun and Woven Goods; 54. Furs; 55. The Hydrostatic Press; 56. Fur and the Fur Trade; 57. Bases, Alkalies, Salts; 58. The Whale and its Products; 59. The Whale Fishery; 60. Silk and the Silk-worm.

THE HEADMASTER of the United Westminster School says: "The lessons are admirably sketched, the matter always attractive, and best of all it is accurate and sound. This system of gradually building up knowledge, line upon line, precept upon precept, is the only true way to proceed with young people, it awakens attention and stimulates interest from the beginning, and as a consequence a stream of useful information is left behind, which increases by accretion until it enables a boy to think for himself, and that point reached, he is safe. For this step by step training, your books are far and away the best I have seen. The illustrations are apt and to the point and such as boys and girls can grasp, while the type and printing lend assistance to the mastery of the subject."

PRESS OPINIONS

TEACHERS' AID.—"Among many good Science Readers we dub these the very best by reason of their intense practicability. They are most skilfully planned, dealing in turns with the common properties of bodies, the nature, growth, and structure of plants in general, and with some of the leading types of the animal creation. The language is simple, being conducted in conversational style, and the information imparted is well within the capacities of the little ones for whom the books have been so well prepared. The illustrations, too, are especially good, and lend themselves exceedingly well to black-board illustration."

SCHOOLMASTER.—"In writing the lessons, the personal method has been adopted, and we must congratulate the writer upon having secured three most admirable and intelligent puppets by which to transmit his facts and explanations to young readers. The lessons are very properly short ones. Both writer and publisher have done all they can to produce a pleasing cross between a reading-book and a text-book, and teachers who wish their scholars to possess a considerable amount of information about common things will probably find these little books of service to them."

PRACTICAL TEACHER.—"Mr. Murché has succeeded in giving an air of reality to his lessons, and rarely does he offend by creating improbable situations. The books would be admirable aids to recapitulation of oral lessons, for which purpose we strongly recommend them."

SCHOOL GUARDIAN.—"They are brightly written, and children will find them interesting."

CATHOLIC TIMES.—"This excellent series of reading-books is supplementary to the author's *Object Lessons in Elementary Science*, published last year for the use of teachers. They communicate to children in a very easy and attractive manner a good deal of useful knowledge. They are equally useful for teaching in class or for home study. They are grounded upon an excellent idea. Playing at keeping school is one of the commonest of children's pastimes. In the first lesson of the first of these volumes, which are well printed and well illustrated, we are introduced to three children who amuse themselves in this manner, repeating in their own simple language the teacher's object lessons during school-hours. Short summaries of each chapter serve to impress the facts learnt upon the youthful mind."

EDUCATIONAL NEWS.—"The Headmaster of Boundary Lane Board School, Camberwell, London, has made all teachers who seek to give effective lessons in Elementary Science his debtors. . . . He who would teach science effectively and enjoyably should see, and he will be sure to use, these *Science Readers.*"

BOARD TEACHER.—"A careful examination reveals throughout the indefinable and practical knack of the successful teacher. A non-teacher could not possibly have produced these books. The acquirement of scientific knowledge in conjunction with the cultivation of the faculties of observation and correct reading will be made a pastime rather than a task by the use of these admirable readers. Their get-up and illustrations are excellent, and the latter are in all cases original and exactly suited to the text."

NATURE.—"In the elementary schools where the rudiments of knowledge about properties and things are taught these books may be introduced with advantage as reading-books. The style is conversational, and every effort appears to have been made to convey the information in simple language, as well as to make it interesting."

SCHOOL BOARD CHRONICLE.—"The fourth book of Murché's *Science Readers* continues and develops in a measure the subjects dealt with in the earlier books. Full use is made of what has been taught before, but the lessons are nevertheless complete in themselves. They take the form of talks between Mr. Wilson, the teacher, and his pupils, accompanied by a variety of demonstrations and experiments, these latter being, in the book, represented by a remarkable liberality of illustration. The author looks especially to these readings to serve as an aid to the oral lessons, as increasing the interest of the scholars and fixing the facts and the reasoning processes upon their minds. The sixty short chapters cover a widely representative variety of subjects, from the various properties of matter to branches of animal and human physiology and natural history."

JOURNAL OF EDUCATION.—"Mr. Murché supplements his *Object Lessons in Elementary Science* (already most favourably noticed in these columns) with these Readers, which are remarkable for entertaining style, extensive knowledge of child-nature, and a delightful, but unusual, combination of extreme simplicity and scientific accuracy. The hand of the skilled, experienced teacher is visible on every page. Altogether, they are the best set of Science Readers suitable for young children that have come under our notice."

A HEADMASTER writes: "Murché's *Science Readers*, like the *Object Lessons in Elementary Science*, will prove invaluable where object lessons are taken, and especially so where Elementary Science is taken as a Class Subject.

"The Readers are simple, clear, instructive, and cannot fail to interest the children."

A HEADMASTER writes: "In these days of enforced work during the evenings and on Saturdays, to prepare for the new subjects in which certificates are required, and which masters who desire promotion must slave at, a well digested series of 'Helps,' like these books of Mr. Murché's, comes as a boon and a blessing.

"I have carefully examined them, and much admire their 'get-up,' illustrations, and syllabus.

"The letterpress shows, throughout, the judgment and practical skill of an able teacher, of wide culture and experience; and the freedom of treatment, the large amount of scientific knowledge, and the homely methods exhibited and distributed in every portion of the books, must place them at the head of our most popular and instructive means of imparting a general and scientific knowledge of animate and inanimate creatures. While they must prove a help in mechanical reading, they will also cultivate and encourage the powers and faculties of observation and correct expression of what they see and hear in their daily life."

By the same Author.

DOMESTIC SCIENCE READERS

By VINCENT T. MURCHÉ.

BOOK I.	BOOK III.	BOOK V.
BOOK II.	BOOK IV.	BOOK VI.

Printed by R. & R. CLARK, LIMITED, *Edinburgh.*

To avoid fine, this book should be returned on
or before the date last stamped below

10M—6-40

JAN 3 [illegible]

1X
518.
M97
V.2

DEPARTM ATION
LAND ST UNIVE

LIBRARY. SCHOOL OF EDUCATION. STANFORD
621337